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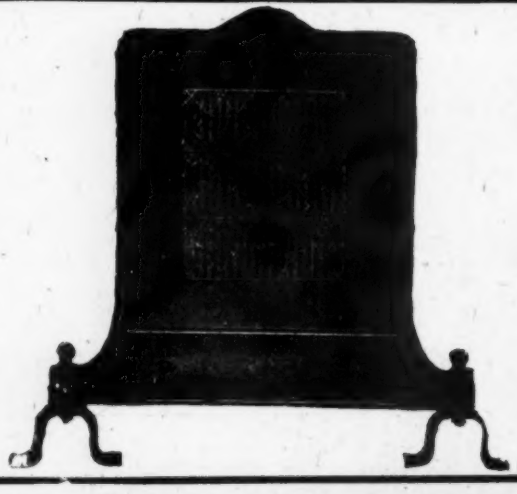

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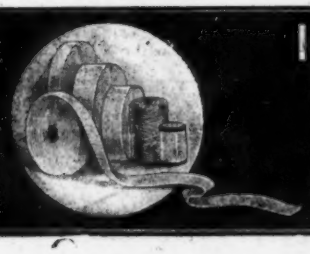

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ELECTRICAL REVIEW.

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LABOUR EXCHANGES AND UNEMPLOYMENT INSURANCE.

WE have received from the National Federation of Employés' Approved Societies a brochure on unemployment insurance with respect to the administration of unemployment insurance by individual firms and industries instead of by Labour Exchanges.

The main argument is contained in an abstract of a paper given by Mr. Henry Lesser, LL.B. (Hon.), Lond., the Chairman of the Federation, which was read at a meeting of the Institute of Industrial Administration held last November under the chairmanship of Sir Wm. H. Beveridge, K.C.B., to whom probably more than anyone else in the country is due the passing of the Labour Exchange Act, 1909.

Of late the Labour Exchanges seem to have fallen into disfavour with both the employers and the workmen, and in the majority report of the Committee of Inquiry set up in June, 1920, by the Minister of Labour to inquire into their administration and working, it is stated that "The witnesses reported that the administration of unemployment insurance by industries on behalf of their own members was the most desirable system in the end, particularly from the point of view of obtaining technical knowledge in the placing of workmen, the creation of a corporate pride in each industry, and a sense of responsibility for unemployment in the industry." We have no wish to deal, from the political side, with the relative merits or advantages of the administration of the Labour Exchanges by the State or otherwise, our concern being rather that a form of administration—whatever that form may be—shall be chosen which shall make for industrial progress.

We do not think that the matter can be judged solely from the standpoint of the employer in general or of the electrical industry in particular. Owing to comparatively less unemployment, it is probable that administration of Unemployment Exchanges and insurance by individual industries would be to the advantage of that industry with which we are more particularly concerned, but each year strengthens the view that matters of this kind have a social as well as a business side, and must therefore be judged as a whole after due consideration of all the interests involved.

We are of the opinion that the question of unemployment could be efficiently and inexpensively dealt with by well-organised industries such as our own, and measures could be taken by committees of employers and employed which would tend to lessen the inequalities and distress of unemployment so far as the varying demand for electrical products would permit, but such a settlement of the difficulty cannot be lightly undertaken.

The primary object of Labour Exchanges and unemployment insurance is not to deal with those who are in a position to help themselves, but to aid the great army of casual and unskilled labour, to save them from destitution through inability to find employment, and to avoid the moral degradation by which it is too often accompanied.

The principle of the management by each industry of its own affairs has been accepted by the Government on the question of unemployment insurance, and it was assumed that many industries would seize the opportunity to contract out, though, as a matter of fact, with the exception of the insurance industry, no special schemes have been sanctioned. Therefore, before any change could be authorised to allow each industry to be self-supporting it must, we think, first be ascertained

whether advantage would be taken of the facilities to such an extent as would reduce the present cost of State administration, and before any industry can take the responsibility of accepting the burden of providing for its own unemployed the incidence of unemployment in each industry must be more efficiently investigated.

The present system of Labour Exchanges has not proved satisfactory. On the one hand, neither the employer nor the employé in the organised industries readily takes advantage of the facilities offered, whilst on the other, a system of doles has been established which often results in deliberate abstention from work and is good neither for the individual nor for the State.

The self-reliance inherent in the British character is such that most satisfactory results have been produced by following the line of voluntary effort. We do not take kindly to State control, but the question has such wide ramifications that we think further legislation would be necessary in order that individual firms in each industry should take their share of the burden, that funds should be properly administered, and that those employés who are not within well-organised industries should be sufficiently protected.

The way from intermittent employment to complete degradation is "a slippery slope," and it is a social duty, as well as good business, to obstruct this road. The considered views of Trade Unions, Employers' Federations, Chambers of Commerce, and similar bodies might well be ascertained to see whether the solution of this difficulty may be sought with confidence in the direction indicated by Mr. Lesser, and, if so, we think that a case could be made for legislation.

The Electricity Supply Bill.

One need not look far into the history of democratic legislation to find many instances in which the views of a small but energetic minority have prevailed over those of a large majority, simply because the latter has "taken things for granted" and assumed that the popular will was sure to be adequately expressed and duly complied with. The consequences of such a decision by default may be irreparable—at any rate, for a period of years—and we think it well to warn our readers who wish to see the Electricity (Supply) Bill passed into law that it may suffer a similar fate unless they take vigorous steps to indicate their wishes not only to the Government, but also to both Houses of Parliament.

As we reported on March 10th, the second reading of the Bill in the House of Lords was approved by a majority of 59 votes to 40. It is clear, therefore, that there is a strong body of opposition to the Bill in that House, and if its supporters do not bestir themselves they may suffer defeat through over-confidence, with the result that the uncertainty as to the future which has brooded over the industry for so long and so detrimentally may be prolonged for years, with disastrous results.

The opponents of the Bill, whom we believe to include some of the London electricity supply companies and, of course, the gas interests, might themselves do well to consider whither their policy will lead them. In six years the time will have arrived when the London County Council will have to give notice of its intention to exercise its powers of purchase of their properties, lock stock and barrel, and in nine years the purchase powers will undoubtedly be exercised—unless in the interim agreements are made to carry into effect co-operatively a scheme of reorganisation. Compulsory purchase on the terms of the Electric Lighting Acts will give no satisfaction to the companies, and the inevitable suspension of the development of electricity supply in view of the pending change of ownership will be in the highest degree prejudicial to the public interest. On the other hand, if the Bill is passed, the County Council offers to agree to a prolongation of the companies' ownership of their distribution systems, in return for easy terms of gradual acquisition of the generating plant. If the Bill is rejected, all this falls to the ground, and the bulk of the Commissioners' work will be worse than wasted, not only in London but also in the provinces.

We earnestly hope, therefore, that all who are interested not only in the development of the electrical industry but also in the public welfare, will take such action as shall unmistakably demonstrate to Parliament that the Bill must be passed this session at all costs.

Since writing the foregoing we have observed with satisfaction that the Special Committee on London Electricity Supply has recommended the London County Council to urge the Government to "take every step in its power to ensure this measure becoming law during the present session of Parliament." This recommendation was adopted by the Council on Tuesday last. We have received also from Mr. Leslie Gordon, hon. secretary of the Conference of Local Authorities owning Electricity Undertakings in London and Home Counties, copies of a letter to members of the House of Lords and an accompanying statement, showing that the Conference represents a plant capacity of 350,000 kW and a capital expenditure of over £12,000,000, and earnestly urging "the absolute necessity" of passing the Bill. We commend these examples to local authorities in the provinces, to the associations representing private enterprise, and to public bodies such as the Institution of Electrical Engineers and the Incorporated Municipal Electrical Association.

Storage Battery Progress.

The particulars which we give on a later page regarding a new type of accumulator have turned our thoughts to speculations on the ultimate effects on the electrical industry of the introduction of a battery having the remarkable properties claimed for this one. Doubtless the earliest response would come from the field of electric traction, which would also offer the largest scope for immediate development; to take moderate figures, if we assume an increased capacity of 200 per cent. with the same weight and volume, the radius of action of an electric vehicle on one charge would become 150 miles, which is ample for all purposes. The limitations to the rates of charge and discharge being removed, the speed of the vehicle could be increased to any reasonable value, and the time required to recharge would be so short that it would offer no obstacle to the use of the vehicle for touring purposes. Hence there would be an enormous development in the use of electric vehicles both for passenger and goods transport, and this would include not only omnibuses but also tramcars and even railway locomotives.

A battery that never sulphates, and cannot be overcharged or over-discharged, is entitled to the epithet "fool-proof," and would be ideal for isolated installations such as those at country houses and farms; but still greater possibilities would open, for the question of storage on the large scale would assume a new aspect. The ability to store three times the energy in the same space, and to discharge at an almost unlimited rate, together with immunity from damage due to neglect, would render such a battery of great value to power stations. The use of batteries for motor launches, for starting aeroplane engines, &c., would be developed, and as always happens in such cases, entirely new applications would speedily crop up.

The storage-battery industry would enter upon a period of unparalleled prosperity, in which all battery makers would share, for the demand would be far too great to be dealt with by any one firm; but obviously, before the great developments that we have outlined could be realised, the accessory apparatus would have to be provided, involving activity on the part of the makers of chassis and vehicle bodies, controllers, motors, switchgear, &c., and the full effects of the improvement would not be experienced for a period of years.

THE EARTHING RESISTANCE AS A PROTECTION AGAINST VOLTAGE RISES.

By MAJOR KENELM EDGCUMBE.

The value of the neutral-point earthing resistance in connection with systems of fault protection is now fully recognised, but the fact that it also forms the best safeguard against the ill-effects of the transient voltage rises and surges which accompany faults is not so well known.

On the Continent and in the United States, where it was customary until comparatively recently to run with the neutral point insulated, an intermittent earth was by far the most dreaded of all faults, since it was almost certain to be followed by an extensive shut-down. Almost the only argument in favour of running with the neutral point insulated is that, on paper, it should be possible

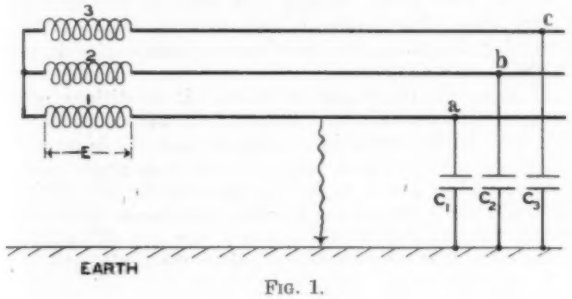

Fig. 1.

to continue to operate the system with an earth on one phase. Experience, however, has shown conclusively that, except on very small low-voltage systems, this argument is untenable, first owing to the moral certainty that an earth on one phase will spread to the others, and so become a short circuit between phases, but still more owing to the destructive effects of the transient voltage rises which accompany such an earth.

Voltage Rises due to Earths.

The origin of such voltage rises will be clear from the following considerations:—

1, 2, and 3 in fig. 1 represent the three windings of a three-phase star-connected generator or transformer, on a three-phase system. Each line has a capacity to earth represented by C_1, C_2, and C_3 respectively. Under normal conditions the neutral point of the system will be at earth's potential, as shown diagrammatically in fig. 2. Should an earth develop on line 1, for example, the voltage of that line to earth will be at once reduced to zero, and that of lines 2 and 3 to the delta voltage

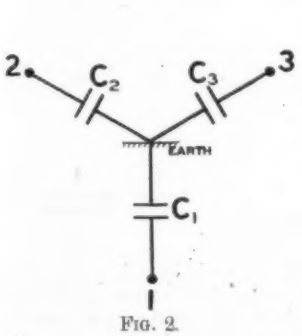

Fig. 2.

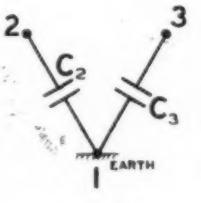

Fig. 3.

above earth, that is to $\sqrt{3}\,E$, where E is the star voltage. The conditions are, in fact, as shown in fig. 3. The result is, therefore, that the capacity C_1 is short-circuited by, and discharges through, the fault, whilst capacities C_2 and C_3 each receive an increased charge due to the increased voltage of lines 2 and 3 to earth.

Referring again to fig. 1, and supposing the fault to occur near *a*, this point is suddenly reduced to earth's potential, and the condenser C_1 is thereby short-circuited. Between the points *a* and *b* is a voltage $\sqrt{3}\,E$ (*i.e.*, the delta voltage of the system), so that a capacity current of $\sqrt{3}\,E \omega C_2$ flows from *b* through C_2 and back through the fault to *a*. Similarly, a current equal to $\sqrt{3}\,E \omega C_3$ flows through C_3 and the fault. These two currents are 60° out of phase, so that, if the capacity of C_2 and of C_3 is C, the total current through the fault is $(\sqrt{3}\,E \omega C + \sqrt{3}\,E \omega C) \cos. 30 = 3\,E \omega C$. This, then, is the capacity current which flows through an earth fault, should one occur on an insulated three-phase system.

It will be noted that lines 2 and 3 are now subjected to a voltage to earth of $\sqrt{3}\,E$ or, say, 75 per cent. greater than the normal; but if that were all, there would be nothing much to fear, since the insulation of the system should be such as easily to withstand this moderate rise. The danger lies, however, in the extreme suddenness with which the change of conditions occurs. The voltage is applied suddenly, and the capacity current taken by C_2 and C_3, passes through the generator or transformer windings in the form of a steep-fronted wave. This wave rushes in from the lines, and is partially reflected where it meets the windings and again at the neutral point. At each reflecting point there is a rise of voltage involving, in all, a possible rise to four times the star voltage of the system; moreover, a very severe strain is thrown upon the end turns of the windings.

After the first impact, *provided the dead earth persists*, the system settles down to a steady state with a voltage on the sound lines (2 and 3) of $\sqrt{3}\,E$ to earth,

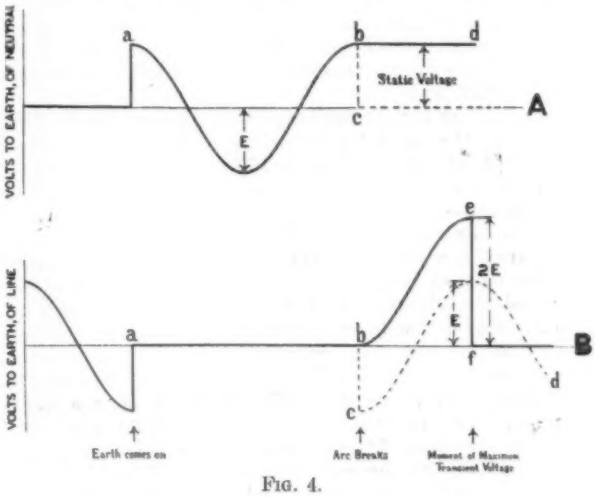

Fig. 4.

and the duration of the transient strain on the insulation is so short that the danger of a breakdown is more or less remote.

Intermittent Earths.

Unfortunately the proviso that the dead earth should persist is seldom fulfilled, except in the case of a metal-to-metal contact. It will be seen that the fault is shunted by the capacity C_1, which renders the arc very unstable, and in the majority of cases it is quenched and re-started at every (or every alternate) half period.

So soon as the arc breaks, the conditions of fig. 3 are once more replaced by those of fig. 2, or, in other words, the connection between *a* and earth (fig. 1) is broken, and the potential to earth of the point *a*, after being zero, suddenly becomes E. At the same time the potentials to earth of the points *b* and *c* are reduced from $\sqrt{3}\,E$ to E. It thus comes about that the charge which the capacity C_2 and C_3 held at a voltage of $\sqrt{3}\,E$, is now reduced to that which the same capacity can hold at a voltage E, and the surplus charge is left upon the lines and distributes itself between their three capacities C_1, C_2, and C_3, across each of which it produces a voltage of E to earth. The charge so left upon the lines is a purely

static charge, and since there is now no earth connection at any point, it can only leak away slowly over insulators, &c.

Fig. 4 shows the sequence of events, as just outlined. The ordinates represent voltages to earth, and the abscissæ times. Curve A shows the voltage to earth of the neutral point, and curve B that of the faulty line. Until the occurrence of a fault, the voltage of the neutral point to earth is zero, owing to the fact that the three capacities to earth are the same. Upon the occurrence of a dead earth, the voltage of the faulty line at once falls to zero, whilst that of the neutral point of the system rises to the star voltage above earth. This is shown at *a* on each of the curves in fig. 4. So long

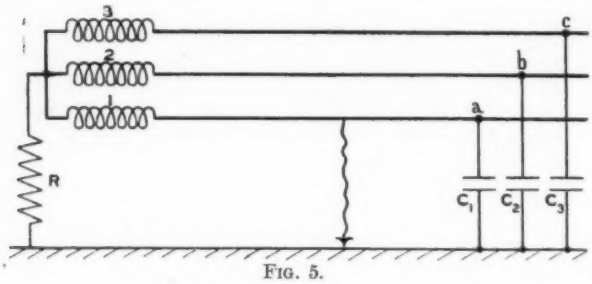

Fig. 5.

as the earth contact is maintained, the faulty line remains at earth's potential, and the voltage of the neutral point rises and falls periodically in the manner shown.

For the reasons already given, it is probable that after, at most, a few half periods, the arc will be extinguished, and this will occur at the moment of zero current which, the circuit being very reactive, may correspond with the moment of maximum voltage to earth (point *b*).

Were it not for the capacity of the lines to earth, the voltage of the neutral point would at once fall to zero, whilst that of the faulty line would rise to E, as shown by the dotted line *b*, *c*. What actually happens, however, is as follows:—

Up to the moment of rupture, the voltage across the capacities C_2 and C_3 (fig. 1) is $\sqrt{3}$ E, and the electrostatic charge on each is $\sqrt{3}$ E C. Directly the arc is broken this voltage falls to E, and, with it, the charge on each falls to E C, so that there is a surplus electrostatic charge which distributes itself over the system. It is a perfectly steady charge, and it can be shown that its voltage to earth is E, *i.e.*, the maximum value of the star voltage. This is represented in curve A of fig. 4 by the straight line *b*, *d*. The system being now insulated from earth, the charge can only flow away slowly by leakage or, in other words, the line *b*, *d* will be nearly horizontal.

Quite independently of this charge, the three lines are subjected to the ordinary periodic rise and fall of voltage, as shown, for the faulty line, by the dotted curve *c*, *d* in fig. 4B. This periodic alternating current voltage is superposed upon the static voltage of the neutral, and gives the curve *b e* of fig. 4B, showing a possible rise to 2 E, namely, to twice the star voltage of the system.

At or about this time the fault will probably break down again, the voltage then suddenly falling to zero, at *f*, and the whole cycle of operations repeating itself. It must be remembered that each time the voltage rise occurs, followed by a discharge, a surge is sent along the line in each direction from the fault, and this may occur some hundred or more times per second. It will be readily understood how such a bombardment, accompanied as it is by voltage rises at various points, is the cause of such serious breakdowns to insulators, windings, cables, &c. In fact, this phenomenon, the "Aussetzende Erdschluss" of the Germans or the "Arcing Ground" of the Americans, is held by them in greater awe than almost any other form of fault. In this country, on the other hand, comparatively little has been heard of the trouble, owing undoubtedly to the fact that it has long since become the rule to earth the neutral point through a resistance so soon as a system reaches any considerable size—not so much, be it said, with the idea of guarding against these voltage rises as in order that the well-known advantages of leakage protection might be secured. It is often forgotten, in fact, that such earthing likewise affords the most complete protection against these dangerous transient voltages, the origin of which has just been described.

Earthing the Neutral Point as a Protection Against Transient Voltage Rises.

Fig. 5 shows the same system as fig. 1, but with a resistance R connected between the neutral point and earth. On the occurrence of an earth fault, the current passing through the fault will be the capacity current added to a resistance current equal to E/R. Any initial voltage rise due to the readjustment of potentials, which will still take place, is only half what it was in the former case, since there is now no reflection at the neutral point (*i.e.*, the maximum possible rise is to twice the star voltage).

In this way the steady short-circuit conditions are reached with a minimum of disturbance, but the chief difference is observable in connection with the breaking of the arc. In the first place, the earth is much more stable and less liable to sudden quenching. Secondly, the lower the value of the earthing resistance the more nearly the point of breaking (zero current) will correspond with that of zero voltage, since the fault current will be more nearly in phase with the star voltage of the faulty line. For this reason, the static charge left on the line at the moment of break is of much lower potential and has, moreover, a direct path to earth through the resistance, and consequently, will have fallen practically to zero by the time the next half wave is superposed upon it.

Fig. 6, which corresponds with fig. 4, shows the sequence of events. The earth comes on at *a*, as before, and the arc is extinguished at *b*. Instead of breaking circuit at the point of maximum instantaneous voltage (*b* in fig. 4), the break will occur later in the cycle, the lag being greater the lower the ohmic resistance of R.

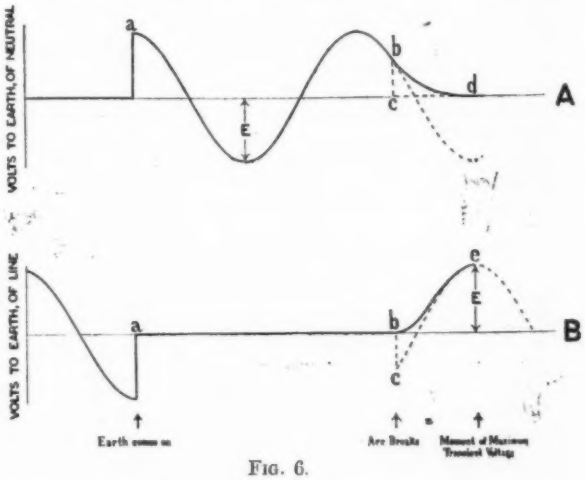

Fig. 6.

In the case shown in fig. 6, the resistance is assumed to have such a value that the active (resistance) component of the fault current is slightly greater than the reactive (capacity) component. Under these circumstances, the static charge which is left on the line has a voltage to earth represented by *c*, *b* (curve A), and during the next half-cycle this charge will have passed to earth through the resistance R, and the voltage to earth will again be zero (point *d*). The curve *b*, *e* (fig. 6 B) shows the rise of voltage of the faulty line under these conditions, and is made up of the instantaneous phase voltage, superposed upon the corresponding value of the neutral point voltage (curve *b*, *d* of fig. 6 A). It will be noted that the maximum value of the voltage to earth cannot in this case exceed the star voltage E.

It was mentioned above that the value assumed for the ohmic resistance was such that the active component of the fault current was slightly greater than its reactive component. If the two components were equal, the voltage rise would still be less than 7 per cent. above the star voltage and the total fault current about 40 per cent. greater than that due to capacity alone.

It must be remembered, moreover, that the earthing resistance forms a valuable protection against pressure rises due to other causes besides intermittent earths. For example, the accumulation of atmospheric charges on the line, which are often a source of considerable trouble in the case of overhead lines. Again, the danger resulting from any surge, such as that due to a lightning discharge in the neighbourhood, is very much reduced by earthing the neutral, since there is then no reflection at the neutral point such as occurs—with its attendant rise of voltage—on an insulated system.

The advantages of earthing through a resistance, as opposed to earthing direct, are too well known to need repetition. Suffice it here to point out that the danger of a surge is a function of the energy which accompanies it, so that there is everything to be gained by isolating a line whilst it is carrying a definitely limited current, instead of the unlimited current which flows in the case of a dead earthed neutral.

Other Methods of Protection.

Although, as has been said, the danger of running an important system with the neutral insulated was long ago recognised in this country, in the United States it is only recently that this has been the case, and in Germany the preponderance of insulated systems is still considerable. It is argued that, in the case of overhead lines, earths are of frequent occurrence, and in certain cases may be of so transitory a nature that it is often unnecessary to isolate the line. The answer to this argument is that it is undoubtedly better practice to run two lines of reduced section, each equipped with leakage protection, and either of them capable of carrying the load under emergency conditions. If the earth proves to be only temporary, the circuit can be immediately reclosed, but if permanent, the line is cut out before the earth has had time to develop into a short circuit. With an insulated system, on the other hand, quite apart from the danger of over-voltages, it is impossible to isolate the faulty section until a short circuit has developed.

In the States, more and more systems are continually being earthed, and it is safe to predict that before long the Continent of Europe will follow suit. In the case of systems which are still run with insulated neutrals, two methods are in use for reducing the danger from over-pressures. One is the American "Arcing Ground Suppressor," by means of which, should one of the three phases go to earth, the arc is suppressed by that phase being automatically connected direct to earth. The danger of this arrangement is that a certain time necessarily elapses between the occurrence of the fault and the automatic grounding of the line. During this interval the violent surges of an insulated system are being projected along it. In some cases the danger period is purposely prolonged by the introduction of a mechanism which reopens the earth connection twice or even three times in succession, with the idea that if, in the meantime, the fault has cleared itself, permanent earthing may be unnecessary.

The other method is by means of the "earthing coil," due originally to Petersen, which gives plenty of scope for mathematical disputation, and has, consequently, found a certain amount of favour in Germany. The underlying idea is quite simple. It was shown that on the occurrence of an earth, a capacity current, approximately equal to $3 E \omega C$, flowed through the fault, and that it was this current which was the cause of the trouble. The earthing coil is a choker connected between the neutral point and earth* (in the position, in fact, of the earthing resistance R in fig. 5), and its function is to neutralise the leading fault current by an equal and opposite lagging current.

*It has also been proposed, as an alternative, to connect a three-phase choker between lines and earth with the same object in view.

Fig. 7 shows the respective paths of these currents by dotted lines. The capacity current is, as has been said, approximately equal to $3 E \omega C$, and the lagging current due to the earth coil (E C, fig. 7) is approximately $E/\omega L$. The capacity current leads the star voltage by 90°, and the choker current lags behind it by approximately the same angle; so that these two currents are more or less in opposition to one another, and if we make $E/\omega L = 3 E \omega C$, they will be equal in magnitude also, so that there will be no current flowing through the fault This condition will be fulfilled if $3 \omega C = 1/\omega L$. As a matter of fact, it is not possible entirely to neutralise the capacity current, since there is, necessarily, a certain amount of self-induction in the capacity circuit and of resistance in both circuits, but the fault current can usually be reduced to some 10 per cent. or 15 per cent. of its original value.

Attractive, and apparently simple, as this proposal may seem at first sight, there are several very serious objections to it. First, it will be noted that the relation $3 \omega C = 1/\omega L$ is the condition for resonance at the frequency of the system, which is anything but a state of affairs to be sought after.

In order to avoid resonance (which has the effect of raising the voltage of the neutral point and with it that of the rest of the system to an indefinite value above earth) it has been suggested to give the choker a

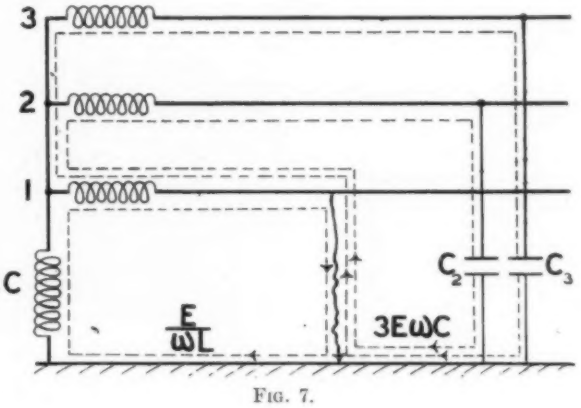

Fig. 7.

saturated core so that with any considerable rise of voltage the value of L is reduced, and so the relation $3 \omega C = 1/\omega L$, necessary for resonance, no longer holds good. It must not be forgotten, however, that even if this is the case for the fundamental frequency, it may still resonate at the frequency of one of the harmonics. For example, if owing to the saturation of the core, the self-induction falls to one-ninth of its normal value, resonance will have been established with the triple harmonic. Moreover, with a saturated core, a comparatively small drop in the working voltage (such as is more than likely to occur simultaneously with a fault) will throw the earthing coil out of tune and thus render it useless for protective purposes. In fact, satisfactory functioning and freedom from resonance may be said to be mutually antagonistic attributes of the earthing coil.

Another serious objection to its use lies in the necessity of re-tuning it whenever there is any change in the capacity of the system which it controls—for example, if a branch circuit is cut in or out, the self-induction of the coil must be correspondingly altered. On a complicated system such tuning is practically impossible, and yet until it has been done the line is without protection. Even on a simple system, if a branch is automatically isolated owing to the occurrence of a fault, it will be some time before the earthing coil can be re-tuned, and the system is without protection just at the moment when a further earth is particularly likely to occur.

Conclusions.

From what has been said it seems that the following conclusions may be drawn:—

1. Three-phase systems with insulated neutrals are dangerous owing to their liability to transient voltage rises due to intermittent earths.

2. The connection of the neutral point of a three-phase system direct to earth is inadvisable owing to the unlimited current which may flow in the event of an earth fault.

3. Earthing the neutral point through a resistance affords complete protection against voltage rises due to intermittent earths. It is valuable in suppressing rises due to all other causes, limits the current in the event of an earth fault, and, moreover, enables advantage to be taken of leakage tripping.

4. The earthing choker is valueless on complicated systems, always involves a serious risk of resonance, offers no advantages over the earthing resistance as a means of suppressing intermittent earths, and is useless as a protection against voltage rises due to any other causes.

THE LEAD-HYDRATE STORAGE BATTERY.

To write of a new lead accumulator requires some courage. In the course of our long experience we have seen so many new lead cells, and have listened to the rhapsodies of so many inventors, that our first impulse on hearing of another is to put on our most sceptical armour and to harden our heart, and we have no doubt that many of our readers on seeing the heading of this article will smile sardonically.

But no one will aver that the development of the lead cell has attained finality, and for long years we have looked forward to the day when a foolproof battery would be produced. We are assured that that hope has at last been fulfilled.

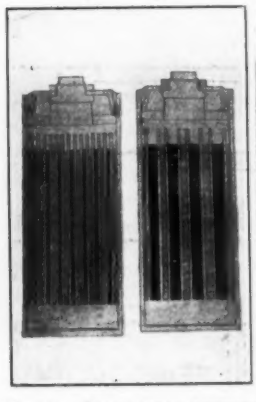

Fig. 1.—Comparison between Ordinary Cell (Left) and Lead-hydrate Thick-plate Cell.

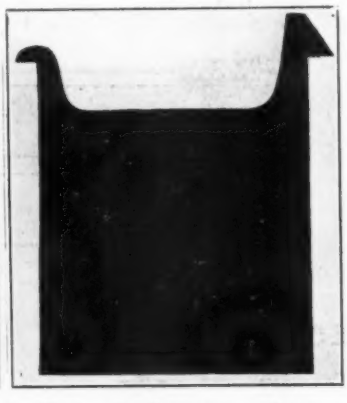

Fig. 2.—Standard Lead-hydrate Plate for Stationary Battery, 12″ × 12″ × ¼″.

A battery has been placed on the market, invented by an Englishman, and made in London workshops, for which the following extraordinary claims are made:—

"It has 300 to 800 per cent. GREATER CAPACITY than any other battery has hitherto attained.

"Its greatest superiority is attained at the HIGHEST discharge rates.

"It is indestructible as a battery.

"It is rechargeable in 15 minutes.

"It CANNOT SULPHATE.

"It has a very much longer life than any other battery.

"It possesses such chemical purity that no 'local action' takes place, consequently any lead hydrate battery may be left for a period of *years*, in any state of charge or discharge, without the slightest change or deterioration.

"It is NOT NEW. Lead hydrate batteries were first manufactured in England in 1910. The very recent demand for a high-capacity battery, with high discharge rating, of light weight and the utmost compactness, for automobile starting and lighting, has resulted in developing this battery to its present high efficiency."

Those are, word for word, the claims made by the makers, who invite the fullest possible inquiry into their accuracy, and are ready to supply full details to anyone interested in the subject.

Were these astounding claims put forward by an unknown inventor with a magic box of mystery, we should decline to publish them unless and until we were furnished with positive proofs of their substantiation. Even now, we quote them not as our own but as the maker's statements. We do so, however, with some confidence, after making as full investigations into the matter as has been possible, and we have no doubt that the makers will be pleased to afford opportunities for those who are interested to verify the facts for themselves.

The lead-hydrate battery is made by Messrs. Siebe, Gorman & Co., Ltd., of London, a firm that has a world-wide reputation in connection with diving and breathing apparatus, but has not hitherto been engaged in the electrical industry, except in a limited degree in connection with submarine telephony. The directors of the company are Sir A. Trevor Dawson, Bart., Messrs. Vincent C. Vickers, Hugh Trevor Dawson, L. I. Garman, and R. H. Davis (managing). Sir Trevor Dawson and Mr. V. C. Vickers are directors of Messrs. Vickers, Ltd. It will be seen, therefore, that the lead-hydrate battery is launched in this country under the aegis of most substantial parents and god-parents, whose word will not lightly be questioned.

The battery, however, is not new. It has, in fact, been manufactured on a large and increasing scale in Canada for the past four years; a company incorporated with a capital of $1,000,000 is handling it in the Dominion, and one with ten times that capital is about to commence operations in the United States. These companies are under common control, and will retain the patent rights for the countries named; the British company has the rest of the world rights. The first lead-hydrate batteries were made in this country in 1910 on

Fig. 3.—Standard Lead-hydrate Plate for Electric Vehicle Battery.

Fig. 4.—Plate for Submarine Battery, 24″ × 12″ × ¼″.

a modest scale by the inventor, who served as an officer in the British Navy during the war, and afterwards commenced the manufacture of lead-hydrate starting and lighting batteries for motor-cars in Winnipeg, with immediate success. He returned to this country, therefore, not as the inventor of an untried novelty, but as the founder of a new industry with a device of proved merit.

In external appearance the lead-hydrate battery differs little from an ordinary lead battery; the same grids can be successfully used, though they are not so suitable as the special types that have been evolved. There are, however, differences in detail of fundamental importance. From the accompanying illustrations it will be seen

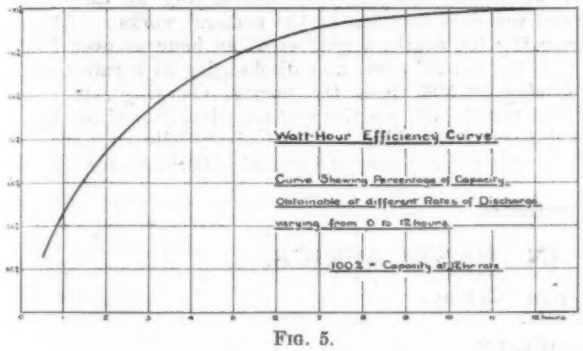
Watt-Hour Efficiency Curve.
Curve Showing Percentage of Capacity,
Obtainable at different Rates of Discharge,
varying from 0 to 12 hours.
100% = Capacity at 8hr rate.

Fig. 5.

that the plates are very much thicker than those of the batteries with which we are familiar; the density of the electrolyte (dilute sulphuric acid) is much greater (specific gravity 1.340 to 1.350) than is customary in this country. The plates, which are of the pasted type, are put into stock fully formed, and are therefore capable of yielding a discharge directly they are put in the acid, at a pressure over 2 volts per cell, a prolonged initial charge being entirely unnecessary.

A peculiarity of the hydrate paste which gives to these cells one of their most valuable properties is that its volume does not vary under any conditions of charge or discharge; consequently, we are informed, the plates are entirely free from buckling and from shedding of active material, and remain unaltered for years. Further, sulphation does not occur, owing to the chemical purity of the lead hydrate, a quality which cannot be ensured with red lead and litharge. Hence lead-hydrate batteries not only do not require periodical charging and discharging when out of use—they can be left in any

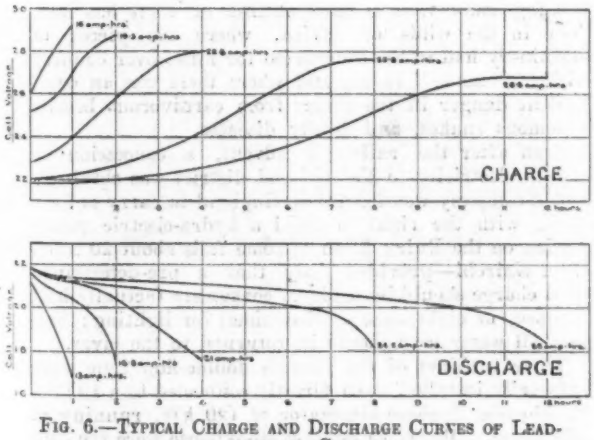

Fig. 6.—Typical Charge and Discharge Curves of Lead-hydrate Cell.

condition, charged or discharged, for a period of years without attention, a proceeding which would spell speedy ruin in the case of a battery made on the customary lines.

It is stated, again, that the whole of the filling is active material, so that the plates have a very high capacity, besides a low internal resistance, while the lead hydrate is very porous, enabling the electrolyte to bathe it freely. Two important results follow: that the cells can be charged at a phenomenal rate, and discharged as quickly, without injury. It is stated that all lead-hydrate batteries can be charged in 15 minutes without deterioration. High capacity and high discharge rate being secured without necessitating a large plate surface, the lead-hydrate cell can be made with few plates, of thick cross-section, instead of the many thin plates ordinarily used for rapid discharges. This is illus-

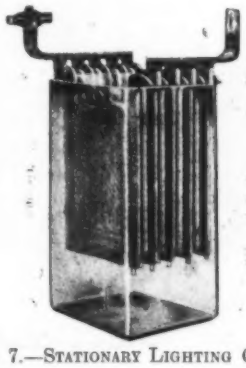

Fig. 7.—Stationary Lighting Cell.

trated in fig. 1, p. 402. The thicker the plates, the more durable they are. In the cases illustrated, the ordinary cell has seven positive plates with a volume of 17.5 cu. in. and a surface of 370 sq. in.; the hydrate battery has four positives with a volume of 33.6 cu. in. and a surface of 211 sq. in., but the latter, it is stated, has the greater capacity and the higher discharge rate. Thick positives, in fact, are characteristic of the lead-hydrate battery.

Owing to the "rugged" nature of the lead-hydrate plates, the charging instructions are exceedingly simple. They read as follows:—"Charge at any convenient rate until the cells gas freely. Continue the charge for five or ten minutes *at a normal rate*, and see that *every cell is gassing freely*. That's all."

The "normal" rate is 10 per cent. of the battery's capacity in ampere hours—that is, the normal rate for a battery of 300 Ah capacity would be 30 amperes. The capability of storing 90 per cent. of the full charge in 10 minutes is an exceedingly valuable property, especially in the case of electric vehicle batteries. We are assured that instead of being limited to a 50-mile radius as at present, vehicles propelled with lead-hydrate batteries of equal weight will have a radius of 300 miles. The importance of this is obvious. For starting petrol

Fig. 8.—Automobile Starting and Lighting Battery.

cars the battery is equally well adapted—in fact, not content with spinning the engine, the starting battery can be used to *drive* a petrol vehicle for a mile or two!—but this, of course, is a *tour de force* which is not recommended, as it may damage the starting gear.

Lead-hydrate starter batteries are available now in complete units or in parts, and in sizes suitable for all the standard British and American cars. They are purposely made of similar weight and capacity to ordinary batteries, because a high-capacity battery when run down would never be fully charged again on the car, and thus a large proportion of its capacity would be idle. A 12-volt battery for a Rolls-Royce, for example, weighs 74 lb. and has a capacity of 72 Ah, corresponding to about 12 watt-hours per lb. of complete cell. Batteries are also made for electric trucks and vehicles, locomotives, and submarines. In figs. 5 and 6 we give some typical charge and discharge curves, and the adjoining test data are characteristic of a submarine battery of the heaviest type, consisting of cells each containing 31 plates (positives 24 in. by 12 in. by ½ in.) and weighing, complete with connector bars, acid, &c., 900 lb. It will be noticed that the watt-hour output per lb. of complete cell exceeds 27 at the 12-hour rate. For railway locomotives, a battery weighing 90 tons would have a capacity of 6,000 kWh, which represents an output of about 30 watt-hours per lb. We understand, however, that the figures given above are far from representing the capacities which can readily be obtained with lead-hydrate cells. Standard plates are shown in figs. 2, 3, and 4, a cell for stationary lighting in fig. 7, and a motor starting and lighting battery in fig. 8.

Hour. rate.	Ampere hour capacity.	Ampere output.	Efficiency. Ampere-hour.	Watt-hour.	Average cell voltage.	Initial volts on charge.	Voltage at end of charge.	Voltage at end of disch.
1	6280	6280	85%	61%	1.89	2.6	2.88	1.68
2	7963	3981¼	87%	66%	2.02	2.53	2.84	1.74
4	9954	2488¼	93%	74%	2.03	2.41	2.82	1.76
8	11513	1439	95%	76%	2.06	2.2	2.72	1.82
12	11850	987½	95%	77%	2.06	2.18	2.61	1.84

Verification of the claims made by the makers and quoted on an earlier page would, of course, occupy a long time, some of them involving periods of years, and consequently we take no responsibility for them; at our request, however, the ability of the lead-hydrate plates to withstand charging and discharging at excessive rates was demonstrated at the makers' works. After charging for nearly a quarter of an hour at over 100 times the normal rate, and discharging at a rate commencing at 500 times the normal charging rate, the plates tested, both positive and negative, showed no sign of injury of any kind. Lead-hydrate cells are now in the hands of the National Physical Laboratory for test.

ELECTRICAL AFFAIRS IN EAST AFRICA.

Impressions of Kenya Colony.

By R. T. MAWDESLEY.

Electrical undertakings are very scarce in Kenya Colony, and, *imprimis*, the writer ventures to issue a warning, with all the emphasis at his command, against anyone from Home, be he old or young, going out to this colony "on spec." Personal experience on the spot, coupled with the knowledge that unemployment at Home is at present very serious, prompts this advice.

The country is very little developed, and is sparsely populated with European settlers; a knowledge of Kiswahili, the language, is absolutely essential; there are really no manufactures, and no industries which call for experienced practical electrical men. Most of the skilled workmen, such as fitters, wiremen, electricians, carpenters, &c., are Indians, and no Europeans whatever are employed in practical or manual work, but only in executive or managerial positions.

Mombasa, which, with Kilindini, forms the chief port, possesses a small d.c. power station, containing two 50-kW generators, belt-driven from two Garrett 80-h.p. engines of the locomobile type.

It was originally owned and operated by a private company, the controlling interest in which was held by Mr. T. Powiss Cobb, but the plant is at present operated by Government, by reason of its not being standard apparatus as called for by the present Electric Ordinance; presumably the Mombasa Electric Light and Power Co., Ltd., was not prepared to go to the expense of installing alternators and scrapping the existing plant. If a supplier of electricity for public purposes discontinues such supply, the Governor may take over the job, and that apparently happened in this case.

At the time when this plant came under the writer's observation there was a third small vertical engine, which was not used; and it is understood that the B.T.H. Co. is installing new apparatus which is not yet in commission.

The fuel was wood, cut up into suitable lengths, and the plant was only run from sundown to midnight, when the fires were allowed to die out. The daily expansion and contraction of the boilers caused grievous trouble with the tubes, which leaked where they were expanded in the plates at the furnace ends, rendering necessary the daily re-expanding of these tubes. Even then it was difficult to keep steam on the peak load, with the inevitable result that the voltage went down; consequently the public and private lighting sometimes looked extremely anæmic. There was no power load.

From Mombasa the Uganda* Railway runs to Nairobi and the East African Highlands, and thence to the terminus, Kisumu, on Victoria Nyanza. It has brought civilisation to the villages on its route, to a certain extent, but a few miles on either side of the single track brings one to primeval conditions; and even from the train itself one can see an abundance of "game."

At Nairobi itself, where the Government offices, railway headquarters, and all important commercial houses are situated, there is a more pretentious display of electrical work. When, during the construction of the "Uganda" railway, the railhead reached the spot where Nairobi now stands, it was decided to establish the railway workshops there; and from these small beginnings there gradually grew into existence the modern town.

At that time—16 or 17 years ago—elephants roamed where Government House now stands; and the engineers had sport which was unique and unrivalled.

Some description of the Nairobi electrical undertaking will now be attempted, but it pretends to be nothing more than a bare outline of what has been done in the wilds of Africa, where the pieces of machinery had to be transported for miles over country without "made" roads, and where there was an ever-present danger in the camps from carnivorous beasts, venomous snakes, and deadly diseases.

Soon after the railway's advent, a concession to supply electricity to Nairobi and district was obtained, and a company was formed in England to carry out the work, with the right to build a hydro-electric power station on the Ruiru River at some falls about 20 miles from Nairobi—provided only that a pre-determined fixed charge should be made to consumers (actually half a rupee, or eightpence at that time) for lighting; and that all water used should be returned to the river.

Three turbines of the Francis double-flow type were primarily installed, each directly connected to a 10,000-V, 50-cycle, 3-phase alternator of 120 kW, running at 500 r.p.m. Messrs. Burstall & Monkhouse were the consulting engineers, and it was to their design and lay-out that all plant was put down, including the later steam station in Nairobi proper. Energy is transmitted over a single line to a terminal station in Nairobi, where the pressure is reduced to 2,500 V; and thence it is

*A misnomer, because this railway does not reach Uganda at all.

distributed to transformers placed in kiosks in the streets at points near the centre of gravity of the load.

The formation of the land at Ruiru is such that little or no conservation of water is possible, and although a concrete dam has been constructed across the river above the power station to increase the static head on the turbines, only the actual water flowing in the river, or very little more, is available to develop electric power. After the station had been in operation for a few years, severe drought descended upon the land, which placed the company in a serious predicament, particularly in 1916 and 1917, because of its inability, through shortage of water in these dry seasons, to run more than two, and sometimes only one, of the generators installed. Connections to the mains had increased so rapidly that on peak loads all three generators were required; and so it became necessary to install some steam plant as a stand-by.

One constant-speed locomobile-type Garrett engine of 200-V h.p. was first installed in Nairobi proper, belt-driving a 120-kW alternator generating at 2,500-V, connected to the l.p. side of the transformers in the receiving station at Nairobi. Two similar sets were subsequently installed, thus duplicating the Ruiru installation.

In passing, it is difficult to understand why constant-speed engines were installed, because of the impossibility, without throttling, of adjusting the load on the alternators when running in parallel, and the difficulty of synchronising.

It was thought, at the beginning, that the three water-driven turbines at Ruiru could supply the whole energy required, and, as a consequence, no arrangements were made at either end of the transmission line for putting the two stations in parallel.

Oil-pressure governors were originally installed on the turbines at Ruiru, but proved unsatisfactory, and were subsequently scrapped. The turbines are at present hand-regulated quite satisfactorily, and at first it was thought impracticable, if not impossible, to operate the two stations in parallel, owing to the fact that the Garrett engines had extremely sensitive governors. Eventually, however, potential transformers were connected to the bus-bars at either end, and an attempt was made experimentally to synchronise the two stations, with the object of obviating any cessation of supply when the steam plant took over a portion, or all, of the load. The results exceeded expectations, and although the hydraulic plant is still hand-operated, the two stations are running in parallel quite satisfactorily; further, the power factor at Ruiru can be materially improved by the over-excitation of the steam-driven generators at Nairobi and the transmission-line losses decreased.

The chief engineer and manager is Mr. Chas. Udall, A.M.Inst.E.E., under whom the undertaking has developed from a comparatively small beginning to its present proportions.

This gentleman some few months ago made an application to the Governor in Council for permission to purchase outright the present company as it stands—in accordance with the terms of the Electric Ordinance; but, as usual in such cases, the Nairobi municipal authorities put forward the standard objection and a plea for compulsory purchase, and the matter remains in abeyance. Mr. Udall's object was to form a new company with local capital, and to develop other falls on the Thika River about 35 miles from Nairobi; but this enterprise is, as stated, held up in the meantime.

The only other plant supplying energy for public purposes is owned by the Thika Sisal Co., Ltd., and is situated on the Thika River some 36 or 38 miles from Nairobi. It consists of one 500-kW alternator, driven by a submerged turbine with a 25-ft. head of water. Current is generated at 500 volts, 50 cycles, and is transformed up to 10,000 V for transmission to the Sisal Co.'s own factory, and also to two or three other Sisal companies, which purchase energy in bulk. The pressure is stepped down at each factory to 190 V and 67 V for use in decorticating and baling sisal, pumping, &c. (Sisal is a cactus-like plant, the fibres of which are used for making twine, rope, &c.). There are a few other privately-owned plants, steam driven, and used for sisal manufacture, and scattered about the country districts are a few individual house-lighting sets of the "Delco" type, or driven by small Petter engines, but these call for no remark.

Some years ago the Government, foreseeing the need for some standardisation regarding the generation, &c., of electricity, appointed the first Government electrical engineer, who was attached to the Public Works Department. This officer was Mr. James McBlain, B.Sc., who will be remembered in East Africa by reason of his having prepared, and drawn up in legal form, the monumental work known as "The Electric Ordinance of the East African Protectorate" (as it was then). This is an achievement of which any man might be proud, forming, as it does, a concise and lucid Bill, which provides for (1) the generation, transmission, delivery, sale, and use of electrical energy; (2) the making and enforcing of regulations appertaining to and governing such purposes; and (3) the provision and enforcing of penalties for contravention of the Ordinance, or of the regulations made under it.

It must of necessity be some years before the Bill can apply even to the few existing undertakings, as a considerable amount of alteration and new work must be done on the largest schemes (*i.e.*, Nairobi) as regards distribution, pressure for lighting and power, &c., but the Government is to be congratulated on having an Ordinance in operation, which is not only a guide for future installations, but stands as a lasting testimonial to the ability of the first Government Electrical Engineer.

Shortly after the Bill became law, Mr. McBlain resigned, and when this occurred one thought his qualified assistant was very well able to "carry on"; but the Government thought otherwise, and another highly-qualified official was appointed, so that there are now two electrical engineers employed by the Kenya Government to do the work connected with the few schemes outlined above.

In "German" East Africa, now known as Tanganyika Territory, Dar-es-Salaam is the only town possessing a public supply, except a very small one at Tanga. The Dar-es-Salaam plant is d.c., driven by Wolff locomobile-type engines. There was a battery of accumulators before the war, but that, together with most of the street-lighting standards, was destroyed during the campaign. The plant was operated by R.E.'s, while G.H.Q. was at Dar-es-Salaam, and was subsequently taken over by the Public Works Department.

There was a wireless station here during the war, and there is one of large capacity on Mombasa Island in operation now.

The writer would draw attention to the great possibilities in front of any development of the numerous water-falls in Kenya Colony, which apparently have not come under the eyes of engineers or investors, possibly by reason of the prevailing scarcity of capital. The writer knows of the existence of more than one fall within 50 miles of Nairobi which would afford a good return on capital outlay, because there is at the moment a demand for energy which the Nairobi Co. finds it quite impossible to meet.

The Home manufacturers of electrical apparatus are barely represented, but the B.T.H. Co. has a branch office at Mombasa, and the British General Electric Co., Ltd. (of South Africa), an agency in Nairobi. America is represented by Childs & Joseph in Nairobi, who deal with the American "G. E." material.

There are great possibilities for electrical enterprise in East Africa, but it suffers from lack of capital. The rupee, originally valued at one shilling and fourpence, has recently been stabilised at two shillings; consequently investors are shy at losing 30 per cent. of the sterling value of their outlay at the start. The cost of native labour and the prices of local commodities have not gone down *pro rata*, and it is unlikely that much will be done until prices have steadied down and values become self-adjusted.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Tea-time" Electric Fire.

Fig. 1 illustrates a new type of fire being manufactured by Electric Fires, Ltd., King Street, Norwich. It consists of an upright fire with a loading of 2 kW in two equal bars. On the top is a flat boiling portion with a loading of 1 kW. The connections to a 2-way switch are such that no more than 2 kW can be put into circuit at one time. The fire is constructed of steel plate, finished in stove-black enamel, with polished nickel facings.

The "Surflex" Wiring System.

We have received from the L. M. Waterhouse Electric Co., 19, Rathbone Place, Oxford Street, W.1, particulars of a new wiring system designed and patented by Mr. L. M. Waterhouse, who was formerly managing director of Simplex Conduits, Ltd. This, the "Surflex," system is applicable to either metal-sheathed or solid rubber-covered cables of various shapes and sizes. The system naturally has much in common with other wiring systems, but there are one or two points which are claimed to make for cheapness without sacrifice of efficiency and to which attention may be drawn. The main feature of the "Surflex" system is the universal

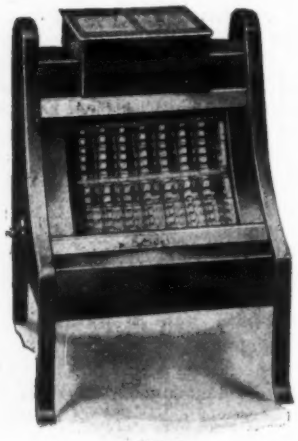

Fig. 1.—The "Tea-time" Electric Fire.

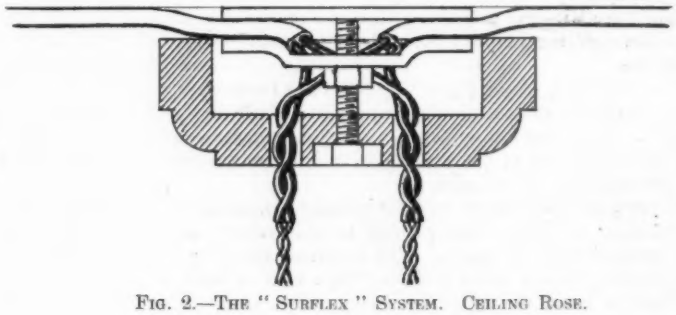

Fig. 2.—The "Surflex" System. Ceiling Rose.

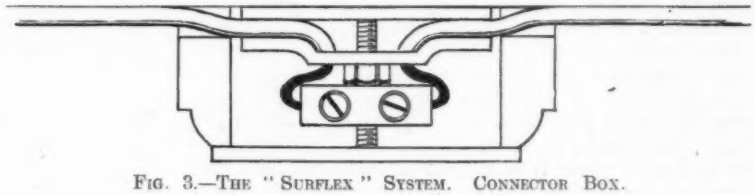

Fig. 3.—The "Surflex" System. Connector Box.

fitting, which, in the case of metal-sheathed cables, is of metal, and for rubber-covered cables of insulating material. The fitting is in two parts—a circular base plate with two screws for fixing and a central screwed stud and a pressure plate which is kept in position by a nut after being slipped over the stud in the base-plate. The metal pressure plate has a domed centre in which are four quadrant-shaped perforations forming outlets for the circuit wires. The insulating pressure plate is flat and has four circular openings. The same fitting is used for making connections, joints, or in mounting accessories. Thus it is possible with one type of fitting to arrange for all connection points:—switches, ceiling roses, wall sockets, and other lighting points. Other accessories of the system include simple fittings for suspending and fixing cables, by means of lead or tinned-brass strip; wood and hard fibre covering boxes; and bonding clamps. In wiring with this system, the base-plate of the universal fitting is first secured in position on wall or ceiling. The circuit wires are fixed in close proximity to the fitting by means of the brass suspenders, and they are then bent at a right angle so as to just overlap the edge of the plate, and the pressure plate is slipped over the ends and the central stud, being secured in position by the nut. Then, the covering box, having been drilled according to the number of wires, is also slipped over the stud and is secured by a circular nut (see fig. 2). In the case of connections, these are effected with the usual types of porcelain connectors, which are placed in a position outside the pressure plate but enclosed by the cover-box, as shown in fig. 3.

An Electric Transporter for Barrels.

Messrs. Elder, Dempster & Co., Ltd., the well-known shipping firm, are well to the front with electrical dock machinery. The latest thing which they have introduced is a new type of barrel transporter, made by the Roadcraft Ltd., Cheapside, Liverpool. This machine is designed to lift a load of one ton, and its main feature is simplicity of control. The transporter is shown in fig. 4.

It is capable of dealing with heavy barrels and hogsheads of imported produce weighing up to one ton, and is controlled in all its operations by one man. The gripping attachment is opened by the driver when the carriage is in its highest position, and by the operation of a change-over switch the carriage is lowered to the height of the barrel. By the next operation the driver releases two heavy arms which engage themselves in the chime ends. After that the controller is reversed to the elevating side and the arms take the entire weight of the cask. The travelling carriage is automatically set to stop at a given point by means of a limit switch, so that when the barrel is lifted quite clear of the ground the driver may immediately start running the machine.

The 36-V battery has an output of 413 A, at a 5-hour rate of discharge. The double-pole change-over switch which controls the hoisting and lowering operations automatically replaces itself in a neutral position. The driving controller is on the left of the driver, and operates forward and reverse gears.

The distance which electric dock transporters are required to traverse is not very great, perhaps 400 or 500 yards, so that a truck with the battery capacity of the new "Roadcraft" model, which can run 50 or 60 miles on one charge, is able to be operated very advantageously. The elevating attachment is removable, and in its place may be arranged a platform, suitable for carrying general merchandise up to 30 cwt. By a second attachment the machine can be used

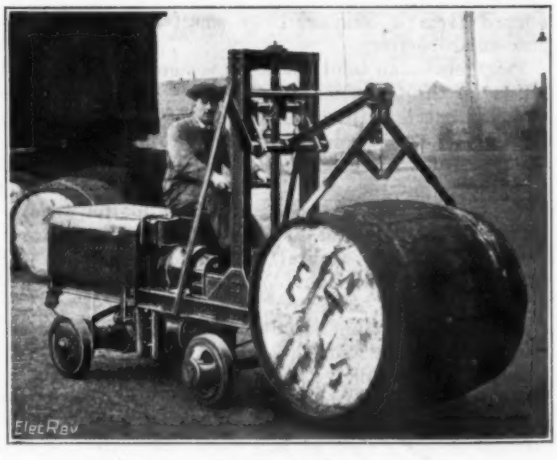

Fig. 4.—An Electric Barrel Transporter.

for stacking goods. The cost of running the machine as a barrel transporter is about twopence per ton-mile.

The truck is strongly constructed and has the driving motor underneath the heavy steel chassis frame. The elevating motor is of special design, and is connected through

a series of gears. The power is transmitted through a worm which is fitted to the bottom of the screw, the latter being mounted on double-thrust ball bearings and self-aligning bearings. Should the controller be left in the full-on position, after the power has been switched off and the brake applied, it is impossible for the truck to be restarted until the controller is set at neutral. This is achieved by two coils, fitted to the switch, which are excited and hold a small locking attachment. As the trucks are in charge of unskilled drivers, the driver's arrangements are simplicity itself. Roadcraft, Ltd., is now working on a model, which, in addition to the barrel-transporting gear, will have a platform 5 ft. 6 in. x 3 ft. 4 in., beneath which batteries will be stored. The platform will hold 30 cwt., and this model will have a haulage capacity of from 3 to 4 tons.

LEGAL.

Wireless Patent Claims.

On Monday last the Royal Commission on Awards to Inventors continued the hearing of these claims. According to the *Daily Telegraph* report it was pointed out by the Chairman (Mr. Justice Sargant) that the commission would have to make a rough approximation to the value of the Lodge Muirhead patent in relation to other patents. The Attorney-General, presenting the case for the Crown, said that the Admiralty had paid the Marconi Co. £257,000, of which £77,000 was in respect of thirteen strategic stations. He contended that the balance of £180,000 liquidated the claim now before the commission. Mr. Hunter Gray, K.C., for the Marconi Co., said that if the commission meant to take into account the amount already paid the company would not submit to arbitration. It was only prepared to discuss the question of what was due on installations in respect of which no royalty had been paid.

The Chairman said the commission had come to the conclusion that what had been referred to it for decision was the amount to be paid by the Admiralty for the use of the patent in the whole of the installations, whether royalty had been paid in respect of them or not. That would be a preliminary step to ascertaining the amount finally due.

Mr. Hunter Gray then asked, says our contemporary, for an adjournment to enable him to consider the legal position, remarking that it was a very serious matter for the Marconi Co.

The commission granted the application for an adjournment. Mr. Hunter Gray stated that in the event of some agreement with the Admiralty he proposed to call Mr. Marconi as a witness.

Ratcliff *v.* Shard.

Mr. Pollock, High Court Official Referee, on March 21st. heard an action in which Mr. George Frederick Ratcliff, electrical engineer, of 42, Upper Baker Street, London, sued Mr. W. J. Shard, of Warfields Hill, Bracknell, Bucks, for £350, balance of charges amounting to £565 for work and labour done, and materials supplied, in connection with an electrical installation at the defendant's house.

The defendant admitted having employed the plaintiff, but said it was, *inter alia*, an expressed or implied term of the employment that the work should be well and efficiently done, and that the prices should be fair and reasonable, but plaintiff, in breach of this verbal agreement, had failed to do the work properly and had charged unreasonably. He counter-claimed £20, the value of certain fittings which had been removed from his London house and not accounted for, and £63 for money alleged to have been paid to make good and complete certain alleged defective work.

The plaintiff's case, as stated by his counsel, and disclosed by his evidence, was that having done a great deal of work for the defendant extending over a period of over 20 years, he was asked in January, 1916, to carry out the installation in respect of which claim was now made. The work occupied from January, 1916, to January, 1917, when owing to the war conditions it was very difficult to obtain labour or materials, which accounted for the higher charges. Defendant was one of plaintiff's first customers and had never entered into any formal contract with him. There had never previously been any dispute, and in this case it was left to him to do what he thought proper. The installation in the house, plaintiff said, was very old and much of it had to be renewed. He was not told to put in an entirely new installation, which would have cost about £1,000, but to make as much use of the old as possible, and the work was made more difficult because the house was full of furniture and he had to keep the light going. He experienced great difficulty in getting materials and obtaining delivery. Some he got from the Simplex Co., and the cable he got from the India Rubber Co., of Silvertown. In consequence of the difficulties in getting materials his private business suffered considerably, and in order to carry out this job he had to sacrifice other customers. All the principal fittings were removed from defendant's London house.

In the course of his cross-examination, the plaintiff said that the old electric lighting was working satisfactorily, but he had to put in new work in consequence of an increase in the number of lights. According to the tests he made he did not think there was any danger of fire and he did not tell the defendant that there was. He denied having told defendant that it would be a £400 job, and he did not regard £600 for a house like defendant's as too much.

The men who had done the work were called to give evidence as to its efficiency and the time occupied by it, the foreman stating that the usual precautions were taken to prevent fire in accordance with the fire office rules.

The Official Referee, in the result, expressed an opinion that plaintiff's charges were excessive, and gave judgment for him for £104 and for the defendant for £10 on the counter-claim for lamps taken away by plaintiff. He gave plaintiff costs on the High Court scale.

PARLIAMENTARY NOTES.

The Engineering Lock-out.—On Monday the adjournment of the House having been moved, Mr. J. R. Clynes called attention to the situation caused by the lock-out in the engineering trade, and discussed the issue involved from the standpoint of Labour. Mr. Hopkinson was among the later speakers, and, as one who was not a member of the Employers' Federation, he criticised the claims put forward by that body regarding management functions. Later the Minister of Labour took part in the debate and justified the Government policy of non-intervention while ballots were still proceeding. Sir Allan Smith spoke on behalf of the federated employers, repudiating the suggestion that they were trying to smash the Unions. They hoped that the Unions would become infinitely stronger. They objected to the action of the men who were trying to undermine the Trade Union principle and destroy discipline within the Unions. The employers and the men's representatives had settled the question of managerial control, but the ballot was against the agreement, and the employers found that they were up against a fundamental principle on which the whole relations between employers and workpeople were based. The House having been addressed by Mr. A. Henderson, the Speaker put the motion "that the House do now adjourn," but it was rejected by a majority of 82—80 for and 162 against.

Sir Allan Smith's speech contained a statement to the effect that if the employers' right to manage their factories were admitted by the unions the employers would be prepared to confer with the unions as to the manner in which the managerial functions were to operate. This statement was followed on Tuesday by lengthy meetings of the organisations, which are watching over the union interests, and it is reported that these organisations were seeking a basis on which such a conference might be held. On Wednesday Messrs. Henderson, Clynes and R. B. Walker had a long conversation with Sir Allan Smith regarding his House of Commons statement.

Electricity Orders Approved.—The following Special Orders made by the Electricity Commissioners under the Electricity (Supply) Acts, 1882 to 1919, and confirmed by the Minister of Transport, were approved, on March 15th, by the House of Lords: Wigston Magna; Cheadle and Gatley; Hayward's Heath and Cuckfield; Johnstone (Renfrew); Milngavie (Dumbarton); Bromyard and Kington; Preston; and an Order amending certain Provisional Orders granted to the Electrical Distribution of Yorkshire, Ltd.

The British Association.—At a meeting held on March 16th, at Liverpool, to arrange for the 1923 meeting of the British Association in that city, Sir William Herdman announced that the Council of the Association had decided to nominate as President for that year Sir Ernest Rutherford, Professor of Physics at Cambridge, who had a world-wide reputation for his investigations into radio-activity, and on the structure of the atom, and for his realisation of the dream of mediæval alchemists in performing the transmutation of elements.—*Morning Post.*

Messages Over Trolley Wires.—Representatives of four big Eastern American railroads and a party of radio experts and engineers at Schenectady, N.Y., recently participated in a test of a new communicating system for electric railroads by talking from a moving trolley on the Schenectady Railroad to a sub-station three miles away, says the *T. & T. Age*. This was the first demonstration of the application of "carrier current" communication to the problem of communicating between the head and rear ends of long freight trains or to expedite train operation held up by faulty block systems. The demonstration was carried out under the direction of the General Electric Co. before a committee of the American Railway Association. The trolley wire, carrying current to the electric engine or trolley car, is used as a carrier of telephone communication by means of another current of different frequency, which is superimposed on the wire and travels along it. In effect, the system transmits messages electrically, partly over a wire and partly through space.

BUSINESS NOTES.

Bankruptcy Proceedings.—Robert Henry Liddell, trading as Liddell & McInnes, 4, The Crescent, Carlisle, electrical engineer.—The receiving order in this matter was made on February 21st, on debtor's own petition. The statement of affairs shows gross liabilities of £359, of which £333 is expected to rank for dividend, while the assets are estimated to realise £178, from which preferential claims have to be deducted of £27, and there is a deficiency of £182. Debtor attributes his failure to bad trade ever since the coal strike, and to tendering for contracts at too low a price, partly to keep his men. It appears that he commenced busines shortly after the armistice, going into partnership with another. This partnership was dissolved in April, 1919, debtor receiving £125 as his share. Later in the same year he started at his present address in partnership with a relation, but this was dissolved in February or March, 1921. Debtor had no capital on starting the last partnership, but his partner brought in £370, of which only £231 had been repaid. Debtor became aware of his position in April last year.

James Victor Figgins, electrical engineer, of Pottery Terrace, Alexandra Road, Newport.—Bankrupt appeared before the Registrar at Newport bankruptcy court last week for his public examination. The statement of affairs showed liabilities amounting to £752, and assets of £38. Debtor stated that the causes of his failure were bad debts, loss on a contract, and the coal strike. Before joining the army debtor was a plumber at Portsmouth. In November, 1919, he commenced business at Pottery Terrace, Newport, trading as Figgins & Bridges, but from February, 1921, he carried on the business alone. Replying to the Official Receiver, debtor stated that his financial position was not wholly disclosed at a private meeting of creditors in September last, when a composition of 6s. 8d. in the £ was arranged; the friend who was to provide the money died before the arrangements could be completed. The examination was closed.

Bernard Barnett, electrical engineer, late of 104, Whitechapel Road, E.—A general meeting of the creditors was held at the London Bankruptcy Court on March 16th, when Mr. Wm. Osborne, accountant, Balfour House, Finsbury Pavement, E.C., was elected to the post of trustee to administer the estate in bankruptcy. The statement of affairs showed total liabilities £2,203 (unsecured £1,475) and assets valued at £1,146. According to the observations of Mr. W. P. Bowyer, Senior Official Receiver, the debtor commenced business as an electrical engineer with £100 capital in March, 1911, at 70, Whitechapel Road, E., under the style of B. Barnett, but transferred it to No. 104 at the end of 1914. From March, 1919, to February, 1920, he also traded there as a garage proprietor and dealer in motor-cars, but abandoned that branch, as it was not a success. In May, 1920, he expended £800 on plant and machinery and started as a manufacturer of electric switchboards, but, owing to foreign competition, that undertaking proved a failure and was abandoned last January. The debtor continued the electrical engineering business until last March, when two partners joined him, each providing £250 capital. They opened a branch shop at 17, Maddox Street, W., under the style of "The Regent Electrical Installation Co.," and both businesses were continued until July 29th last, when the partnership was dissolved and a receiver appointed at the instance of his partners. The debtor then, with £100 provided by friends, again commenced business on his own account and in his own name at 104, Whitechapel Road (first floor), but in September sold the goodwill, office furniture, and stock-in-trade, valued at £100, to a company then formed to acquire it. As vendor he received the £100 in shares, and until the date of the receiving order he acted as managing director of the company. The debtor attributes his insolvency to loss in connection with the garage and motor-car business, to the cost of repairs at 104, Whitechapel Road, to loss on the purchase and sale of plant and machinery, and to law costs.

Frederick Charles Goss, 64, Gloucester Road, Bishopston, Bristol, electrical engineer. The first meeting of creditors was held on March 15th at the Official Receiver's offices, 26, Baldwin Street, Bristol. The statement of affairs was given in our last issue. The case being a summary one was left with the Official Receiver.

Graham Moore Hallett, 7, King Street, Frome, Somerset, electrical engineer.—The statement of affairs shows liabilities of £881, while the assets are estimated to realise £362, from which preferential claims of £4 have to be deducted, leaving net assets of £358, or a deficiency of £522. Debtor attributes his failure to loss on contracts through lack of experience in estimating, depreciation of stock through the falling market, and bad trade. He commenced business at 7, Alexandra Road, Frome, on April 8th, 1919, with £65 capital. In November, 1920, the business was removed to his present address. Debtor became aware of his position in December last. A fair set of books has been kept.

F. E. Mathers, electrical engineer, 10c, High Street, Doncaster.—Last day for proofs for dividend, April 5th. Trustee: Mr. L. J. Clegg, 14, Figtree Lane, Sheffield.

A. J. Wilcox, motor and electrical engineer, The Grange, Farnham Common, Bucks.—Last day for proofs for dividend April 5th. Trustee: Mr. F. W. Davies, 28, Theobald's Road, Bedford Row, W.C.1.

A. E. Dickinson (Crown Electrical Co.), electrical engineer and contractor, 157, Hunslet Road, Leeds.—Trustee: Mr. H. C. Bowling, 24, Bond Street, Leeds, released March 1st.

H. M. Wollman, electrical factor, 9, Greasbrough Road, Parkgate, Rotherham.—Last day for proofs for dividend April 3rd; Trustee: L. J. Clegg, Official Receiver's Offices, 14, Figtree Lane, Sheffield.

R. P. Baker & F. C. Stubbs (Sheffield Electric Construction Co.), 124, Pond Street, Sheffield.—First and final dividend of 4s. 10½d. in the £, payable at the Official Receiver's offices, Sheffield.

Company Liquidations.—Semco, Ltd., electrical engineers, 19, High Street, Shoreditch, London E.—The creditors of the above were called together on March 16th, at the Great Eastern Hotel, Liverpool Street, E.C. The chair was occupied by Mr. F. B. Darke, the liquidator of the company, who submitted a statement of affairs which showed liabilities of £5,952. After allowing £155 for preferential claims the assets were estimated to realise £2,583, or a deficiency as regarded the creditors of £3,369. The assets consisted of equity in freehold premises £257; plant, &c., £507; stock and work in progress £876; book-debts £1,090; and cash at bank £8. With regard to the liabilities, it was stated that £404 was due to the bank and there were cash creditors for £3,016. The directors were creditors in respect of fees amounting to £544, but those claims would be withdrawn. Mr. Darke reported that the company was registered on September 10th, 1919, to acquire a business from the Standard Electrical & Maintenance Co. The goodwill was valued at £2,000. In the 12 months to August 31st, 1920, there was a loss on the trading of £870, the turnover being approximately £19,000. In the following year the turnover was £19,555, and there was a loss on the trading of £4,780. The loss in the latter period was accounted for chiefly through unremunerative contracts, and the electrical strike. In addition, the company opened a foundry at Forest Gate, on which money was lost, and it had since been closed down. The company also lost on manufacture of the Semco sparking plugs. In answer to questions, it was stated that the issued capital of the company was £6,200, of which £2,200 was issued for cash. Originally there were four directors of the company, and up to August of last year they drew £8 a week each. Then for about a month the drawings were increased to £10 weekly, but were again reduced to £8 a week each. In September two of the directors retired. The company had carried out a substantial contract for the Islington Borough Council, and work to the extent of about £2,000 remained to be completed. It was a profitable contract to complete. Mr. P. Houstoun (Messrs. Corfield & Cripwell), said he thought the present position was largely due to misfortune, and he proposed a resolution in favour of the voluntary liquidation of the company being continued with Mr. Darke as liquidator. The resolution was carried unanimously and an informal committee was also appointed consisting of the representatives of the General Electric Co., Ltd., Phœnix-Tester, Ltd., and the Cable Accessories Co.

The principal creditors are:

	£		£
B.T.T. Electric Lamp Co. ...	327	General Electric Co.	104
Metallic Electrical Engineering Co.	115	Vulcan Electric Co.	81
		Phœnix-Tester, Ltd.	82
Metropolitan-Vickers Electrical Co.	64	Cable Accessories Co.	99
		Wholesale Fittings Co.	75

Grafton Dynamos, Ltd.—At a meeting of creditors held at Glasgow on March 17th, the statement of affairs was submitted, also a statement accounting for the loses. The meeting confirmed the appointment of Mr. J. W. MacKinnon, 145, St. Vincent Street, Glasgow, as liquidator under voluntary liquidation. The liabilities (including bank overdraft £996, and trade creditors £429) are £1,419, and the net free assets £119, showing a deficiency of £1,300, and an apparent dividend of 1s. 8d. in the £ subject to realisation and expenses. The share capital was £10,000. The book value of the patents is £5,000, but these are estimated at nil. The losses on trading have been:—To September, 1919, £721; September, 1920, £2,258; September, 1921, £1,333; and from September last to February 27th, 1922, £437.

Midland Electric Co. (Southport), Ltd.—Winding up voluntarily. Joint liquidators: Mr. W. F. Brown and Mr. J. A. Bond, Hoghton Chambers, Hoghton Street, Southport. Meeting of creditors, March 27th, at the liquidators' offices. Particulars of claims by April 30th.

Tinkers, Ltd.—Winding up voluntarily for reconstruction purposes. Joint liquidators: Mr. F. Tinker and Mr. A. E. Chadwick, both of Hyde, who are authorised to consent to the registration of a new company under the name of Tinkers, Ltd.

Thacker, Bell & Co., Ltd.—Meeting of members, April 24th, at Pinners' Hall, Austin Friars, E.C., to hear an account of the winding up from the liquidator, Mr. F. H. Agar

The Adapta Sign and Trading Co., Ltd., 5, Green Street, Leicester Square, W.—Under a compulsory winding up, the first meetings of the creditors and shareholders were held last week at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. A statement of affairs was presented, showing gross liabilities £1,119 (unsecured £769), assets valued at £130, and a total deficiency of £11,027 as regards contributories.

Mr. E. T. A. Phillips, Official Receiver, reported that the company was formed as a private company in September, 1920, with a nominal capital of £15,000, to acquire certain rights and interests in an invention relating to advertising signs. It was called the "Adapta," and was composed of a brass frame which contained a sheet of frosted glass and a sheet of plain glass, between which block letters were held in position in order to display any words which the advertisement required. Behind the frosted glass, a metal box was fitted, containing electric lamps, which, when alight, gave a translucent effect to the advertisement. The metal boxes were manufactured by the Metropolitan Construction Co., Ltd., upon whose petition the winding-up order was made. A few weeks prior to the Advertising Exhibition in 1921, the company ordered from the Metropolitan Construction Co. 140 containers, which were delivered at the Exhibition, the company paying £300 on account. The goods were found to be defective in various respects, and the suppliers agreed to make the necessary adjustments. That arrangement was duly carried out, but the Metropolitan Construction Co. refused to deliver the goods until they were paid for, and they now held them as security for the balance due to them on the order. A £2,200 order for "Adapta" signs for the Advertising Exhibition was placed with the company by Messrs. Kerr & Co., of Shaftesbury Avenue, W.C., but during the Exhibition the goods were taken over by Col. Radcliffe, who paid the company £2,000 on account, in addition to which he arranged to have them stored at the company's registered office, with a view to their being realised by the company on his behalf. The failure of the company was attributed by the directors to losses incurred through transactions with Messrs. Kerr & Co. and to dissensions among the directors, which had an adverse effect upon the company's management and prospects. The Official Receiver was left in charge of the liquidation.

City School of Wireless Telegraphy, Ltd.—Winding up voluntarily. Liquidator: Mr. A. Lloyd, 17, Sedgeley Avenue, Sedgeley Park, Manchester. Meeting of creditors, March 29th, at 61, High Street, Manchester. Particulars of claims to the liquidator by April 15th.

Electric Brass Wares, Ltd.—Winding up voluntarily. Liquidator: Mr. T. E. A. Killip. Meeting of creditors, March 28th, at 21, Tempest Hey, Liverpool.

Sutton-in-Ashfield Motor and Electrical Engineering Co., Ltd.—Meeting, April 26th, at 1, King John's Chambers, Bridlesmith Gate, Nottingham, to hear an account of the winding-up from the liquidator, Mr. J. Keetley.

Cedes Electric Traction, Ltd.—First and final dividend of 10s. 8d. in the £, under order of the Court, payable at the offices of the Official Receiver, Carey Street, W.C.

Swift Electrical, Ltd.—A petition for the winding-up has been presented to the High Court by Messrs. Watshams, electrical engineers, 33, King Street, Covent Garden, W.C., and will be heard in London on April 4th.

Receiver Appointed.—New Welding Co., Ltd.—Mr. E. D. Basden, of 73, Basinghall Street, E.C., was appointed as receiver on March 8th, 1922, under powers contained in debentures dated June 29th, October 10th, and November 4th and 9th, 1921.

Dissolutions of Partnership.—Edwards & Barcham, motor-car dealers and manufacturers and repairers of electrical accessories, 29, Portman Mews South, London.—Constance Wormald Bircham and Christophe Edwards have dissolved partnership.

Rollinson & Greensmith, electrical engineers, Tavistock Chambers, Beastmarket Hill, Nottingham.—Mr. J. E. Rollinson and Mr. E. J. Greensmith have dissolved partnership. Mr. Rollinson will attend to debts.

Trade Announcements.—Messrs. W. J. Howell & Co., Ltd., of Leeds, have appointed Mr. H. De Grey Firth, of Prudential Buildings, Leeds, as their agent for electrical woodwork in Bradford, Manchester, Newcastle, Hull, &c.

Messrs. Holder-Harrison, Ltd., have removed to 1 and 2, Chiswell Street, London, E.C.

The International General Electric Co., Inc., has changed its London address from Cannon Street, E.C., to Crown House, Aldwych, London, W.C.2.

The name of The Ideal Cinema and Electrical Supplies, Keighley, has been changed to the Ideal Electrical Supplies Co. (partners, Messrs. J. Leach and H. W. Silson), 11, Russell Street. The firm desires to receive electrical catalogues and trade leaflets for retail purposes and general installation wiring and contracting.

The Premier Electric Welding Co., Ltd., announces that as a measure for increasing efficiency it is concentrating a number of its departments in the London area. The head office, technical and research laboratories, and the electrode factory has this week been transferred to Abbey Wood, London, S.E.2 (Phone No. "Woolwich 866," Direct London Exs.), where all communications should be sent.

The Galway Electric Co., Ltd. (Newtownsmith, Galway), whose works have been destroyed by fire, has lost thereby all its catalogues, price lists, and other documents, and it wishes to receive new copies of such publications from all firms with which it has dealt in the past and others also.

The Enterprise Manufacturing Co., Ltd., has removed to Electric House, Grape Street, Shaftesbury Avenue, London, W.C.2, where larger stocks will be kept.

Mr. F. G. Titchmarsh, 23, Soho Road, Handsworth, Birmingham, is now representing the "Jeary" Electrical Co.

Mr. W. Kemp has removed to a larger workshop at Brook Lane, Ashley Road, Bristol, where he desires to receive manufacturers' catalogues, showcards and over-printed advertising matter.

Messrs. Coward & Co., sole London agents for Messrs. Townshends, Ltd., and Messrs. William Pemberton, both of Birmingham, have removed to larger premises in 81, Charlotte Street, W.1.

Mr. J. Michael, of the Ironmarket, Newcastle, Staffs., has removed to 20, George Street, Newcastle, where, in addition to contracting and electrical repairing work, he has a sales counter. Manufacturers and others are asked to send price lists and catalogues.

After April 1st the London office address of Electric Control, Ltd., will be Hastings House, Norfolk Street, Strand, W.C.2. Telephone: City 2487. Telegrams: "Elecontrol Estrand London." Particulars of "Empire" automatic control gear and S/C high-pressure fuses may be obtained there. The firm desires it to be known that it is now acting entirely independently of any other manufacturers of switch gear or control gear.

The Electrical Specialities Co., of Liverpool, is opening a branch at 67, Briggate, Leeds, on April 3rd next, with Mr. Sherwood in charge.

Catalogues and Lists.—The Bastian Electric Co., Ltd., 185, Wardour Street, W.1.—An illustrated price list of plain and artistic "Quartzalite" electric fires, muffle, tube, and crucible furnaces, baking ovens, storage geysers, &c.

Messrs. Richson & Co., 114, New Oxford Street, W.C.1.—A price list giving illustrations of glass pendant fittings, artistic table standards, bowl fittings, &c.

Messrs. Spicer & Co., Ltd., 41, Red Lion Street, Clerkenwell, E.C.1.—March price list of electrical accessories, including motors, lampholders, switches, adapters, &c.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 304, illustrating and describing the English Electric industrial motor; and Publication No. 319, a well-illustrated and detailed description of an electrically-driven reversing rolling-mill at the Skinningrove Iron Works, Yorks.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., U.S.A.—February—March number of "Contact," the company's publicity magazine.

Mr. Albert Morgan, A.M.I.E.E., 138, Gower Street, W.C.1.—An illustrated price list of pulley-blocks, crabs, rail benders, lifting jacks, cranes, &c.

Metallic Engineering Co., Ltd., Meta House, Corporation Street, Birmingham.—An illustrated and priced list of "Meta" electric irons, toasters, bowl fires, kettles, &c.

Electric Utilities, Ltd., 1-3, Shelgate Road, S.W.11.—Two leaflets giving illustrations and prices of "Utility" cooker-radiators and electric ovens.

Messrs. W. J. Howell & Co., Ltd., 100, Albion Street, Leeds.—A well-illustrated catalogue of woodwork of various descriptions for the electrical and gramophone industries, including back-boards, indicator cases, fuse-board cases, instrument cases, &c.

Messrs. Gent & Co., Ltd., 25, Victoria Street, S.W.1.—Folder 82, giving illustrations, details, and prices of iron-clad mining telephones, bells, and sirens.

Messrs. Meldrums, Ltd., Timperley, near Manchester.—Two illustrated descriptive lists, dealing respectively with forced-draught furnaces, and mechanical stokers.

The Parsons Motor Co., Ltd., Town Quay Works, Southampton.—A publication giving numerous illustrations of application of Parsons engines to a number of purposes. These include electric welding sets, lighting and power plants, pumping plants, air compressors, locomotives, &c.

Messrs. Vickers, Ltd., River Don Works, Sheffield.—An illustrated leaflet advertising stain- and rust-proof golf-club heads.

The London Factors & Agents, Ltd., 38 and 39, Parliament Street, S.W.1.—A blotting card advertising automobile lamps and other low-voltage metal and carbon filament lamps.

Messrs. J. Calvert, Ltd., 11, Little St. Andrew Street, W.C.2.—A series of illustrated and priced leaflets dealing with "violet-ray" apparatus, electric vibrators, hot- and cold-air douches, and "teleswitches."

For Sale.—By order of the liquidator and receiver of the Remco Carbon Co., Ltd., Messrs. Bradshaw, Brown & Co. will sell by auction, on April 4th, on the premises, Milton Works, Gravesend, the machinery, plant, &c.

Doncaster Corporation invites offers for steam-raising plant.

Halifax Corporation Tramways and Electricity Department has for disposal two 25-kW balancers, made by the Electric Construction Co., Ltd. (See our advertisement pages to-day.)

Private Arrangement.—James Pitkin & Co., Ltd., scientific instrument makers, 28, Hatton Garden, E.C.—In pursuance of Section 120 of the Companies (Consolidation) Act, a meeting of the creditors of this company was held on March 15th, for the purpose of considering a scheme of arrangement which had been proposed to be made between the company and the unsecured creditors. An informal conference of the principal creditors was held in January last, and arising from that conference the creditors had been requested to agree to a scheme by signing a form accepting immediate part-payment. The great majority of the creditors had accepted the arrangement, but the present meeting had become necessary in order to get formal approval. It was pointed out that the necessity for the scheme had risen entirely through the Aladdin Renew Electric Lamp Corporation, Ltd., having failed to pay a large sum of money owing to the company. The Aladdin Co., it was alleged, ordered a number of machines involving thousands of pounds, and refused to take delivery and pay for more than a small proportion. The protection of the Court was sought but, after protracted litigation, by the time the final judgment in Messrs. Pitkin's favour was obtained, the Aladdin Co. went into liquidation. It may be recalled that the verdict was for £3,400 and costs, totalling over £4,000, and of this sum only £1,100 was obtained. The total amount due to creditors was approximately £4,000, and the Ministry of Munitions were creditors for £1,060. It was stated that, under the scheme now proposed, at least 5s. in the £ would be paid promptly, and it was confidently hoped that a further sum would be paid, assuming the company could carry on business and dispose of its stock and assets. The directors expressed great regret that the necessity for the scheme had arisen at all, and they sought the assistance of the creditors, as it was through no fault of their own that the position had arisen, but entirely, as they alleged, through the attitude taken up by the Aladdin Renew Electric Lamp Corporation, Ltd. It was stated that a number of proxies had been received in favour of the scheme, and the result of the voting would be reported to the Court in due course.

Book Notices.—*The Decimal Educator*, Vol. IV. No. 15, March, 1922. London: The Decimal Association. Price 6d.—This issue gives a very full summary of recent developments of the metric system movement; a considerable amount of progress is recorded. The position regarding light, heat, and power units is reviewed by "E.C.B." It is of interest to note that the "all-or-nothing" policy of the Association has been amended in favour of a more gradual reform by assimilation of existing units to the nearest metric equivalent.

The Metropolitan-Vickers Gazette, February, 1922.—This issue includes an article on the Chester bulk supply scheme; notes on electrical progress during 1921; and "The Function and Limitations of Insulation."

"Mechanical Lubricators," a reprint of a paper read by Mr. Aubrey B. Smith, before the Diesel Engine Users' Association. London: The Association. Price 4s.

"Welfare Work," Vol. III. No. 27. March, 1922.—This number contains a review of forthcoming industrial legislation; notes on the progress of the welfare movement abroad; and an article on 'Health Problems Affecting Industry," by Dr. W. F. Dearden, port medical officer for Manchester.

"M. & C. Machine Mining," for March. Glasgow: Messrs. Mavor & Coulson, Ltd. Price 6d. post free.—This issue contains a number of interesting articles upon coal-cutting machinery and its employment.

"Modern Steam Generators for the Efficient Utilisation of Gaseous Fuels, and the Efficient Recovery of Waste Heat," by Mr. P. St. G. Kirke, M.A., A.M.I.C.E. (Messrs. Spencer-Bonecourt, Ltd.).—Reprinted from the journal of the West of Scotland Iron & Steel Institute. Glasgow: Fraser, Asher and Co., Ltd.

Lamp Publicity.—Among the many wedding balls held in different parts of the country in connection with the Royal marriage was a very successful one which took place at Devonshire Park, Eastbourne. An Osram "exhibit" was one of the prize winners. The subject wore an "Osram" lamp costume, and an Osram helmet, the word "Osram" was neatly and prominently printed on the costume, and appropriate publicity literature was in the hand. We understand that Osram dresses have figured at over a hundred similar functions during the present season, have won many prizes, and have been of value to electrical contractors.

French Exports Last Year.—The value of the French exports of dynamos, &c., in 1921 is returned at 19,873,000 fr., that of electrical apparatus at 99,387,000 fr., and that of machine tools at 39,072,000 fr. These figures compare with 41,080,000 fr. in the case of dynamos in 1920 and 6,959,000 fr. in 1919; electrical apparatus 196,963,000 fr., and 27,356,000 fr.; and machine tools 69,780,000 fr. and 17,913,000 fr. in 1920 and 1919 respectively.

The Leipzig Fair.—A *Reuter's Trade Service* message states that from the point of view of attendance, the Fair held in Leipzig, from March 4th to 11th, was a success, over 140,000 visitors having attended. Large numbers of orders were booked in every department, but the fear is expressed that many of these orders will be cancelled, and that the various reservations made by the sellers as to delivery, prices, &c., will give rise to considerable trouble.

An Inquiry from Peru.—The Commercial Secretary to H.M. Legation at Lima, Peru, reports that a local company, with head offices in the United States, is desirous of entering into communication with United Kingdom firms in a position to offer electrical material and fittings, electric elevators, electric motors, gas engines, water pumps, &c. The firm is erecting a number of buildings on behalf of the Peruvian church authorities who, it is understood, are in a position to effect prompt payment for the work. United Kingdom manufacturers and exporters can obtain the name and address of the company on application to the Department of Overseas Trade.

The Shipbuilding Trades Dispute.—According to the *Daily Express* notices were to be posted on Wednesday by the Shipbuilding Employers' Federation making effective the cut of 10s. 6d. from the war bonus as from March 30th and a further cut of 6s. as from April 6th. This decision embodies the second, or modified, offer made to the Engineering and Shipbuilding Federation at the negotiations which were broken off by the men's delegates. The employers had then to consider whether they should stand to their original notice to make an immediate cut of 16s. 6d., with another of 10s. to follow shortly. They have taken the more moderate line indicated.

Bitumen Prices.—Messrs. Shell-Mex, Ltd., announce a further substantial reduction in their prices of Mex bitumen and other bituminous products.

The Clocks at Waterloo.—Over two hundred impulse clock dials have been installed in the recently opened Waterloo Station, including a large four-faced turret clock suspended from the roof in the centre of the station. The whole of this installation was carried out by the Synchronome Co., Ltd.,

Social Event.—The third annual gathering of the Southport Electricity Mains Department staff was held on the evening of March 16th. The proceedings, which took the form of a hot-pot supper and social, were attended by the new borough electrical engineer, Mr. E. Moxon. The health of "Our New Chief" was drunk with musical honours, and Mr. Moxon suitably replied.

New French Companies.—Among the new companies recently formed in connection with the electrical industry in France are the Société La Bakelite (Matières Plastiques), organised in Paris (175, Avenue de Choisy) with a capital of 1,400,000 fr.; and La Compagnie Française des Procédés Emile Hachely (Appareils et Machines Electriques), with headquarters at Saint-Louis and a capital of 1,500,000 fr.

Reduction of Capital.—Turner, Atherton & Co., Ltd., and Reduced.—A petition for the confirmation of the resolution reducing the capital of the company from £175,000 to £140,116 has been presented to the High Court, and is now pending. A list of creditors is to be made out as for April 27th, 1922.

Patent Restoration.—An order has been made restoring patent No. 29,210 of 1911, granted to Henri Francois Etienne Sylvain Dusseris for "Improvements in means for converting a continuous rotary movement into a step-by-step rotary movement."

A Bastian Issue.—A lengthy circular has been issued by Mr. C. O. Bastian, the secretary of the Bastian Electric Co., Ltd., reporting upon the past difficulties and achievements and the present position of the company. The litigation with Messrs. May & Padmore, Ltd., has been settled, and the negotiations with the B.T.H. Co., Ltd., regarding nickel-chromium resistance wire have been satisfactorily concluded, and in place of sub-contracting arrangements previously in force, the Bastian Co. now desires to establish the manufacture of its products in its own premises. This involves the equipment of a suitable factory, and necessitates the raising of £10,000 in first mortgage debenture bonds of £50 each (these will also pay off the existing £3,000 first and second mortgage debentures). The bonds are being offered to shareholders, creditors, and customers, and full particulars of the business of the company can be found in the circulars just issued.

Agricultural Electric Supply in France.—The success of co-operative agricultural electric supply companies in France is shown by the fact that one such company or group of companies possesses 350 km. of line, supplies 50 communes with power, and has a membership of 1,500. The company in question is the Co-opérative Agricole d'Electricité de la Région de Longueil-Sainte-Marie, which held its general meeting on February 26th at Chevrières. The report detailed the satisfactory results of the first year's working, and the meeting sanctioned a dividend of 5 per cent., after providing for reserve fund. This company forms one of five co-operative concerns formed at the same time and grouped under a single management.

Furnace Demonstrations in Holland.—Messrs. Automatic and Electric Furnaces, Ltd., have made arrangements with the Rijksnijverheid-Laboratorium (Dutch Government Industrial Laboratory) at Delft, Holland, to give a week's demonstration of Wild-Barfield furnaces to manufacturers in that country. The demonstrations will start on March 28th, and will continue through the week. Dutch readers of the Review who are interested in electrical or mechanical engineering are invited to attend.

The Johannesburg Strike.—The order calling off the strike of gold miners, employés of the Victoria Falls Power Co., and engineers came into force on March 17th. The men had been out 67 days in all. The mine-workers' union, which numbers 21,000 members, led the way by opposing a ballot as being impracticable, and passing a resolution dissociating themselves entirely from the revolutionary movement.—*Reuter* (Johannesburg).

New Belgian Companies.—There has been formed at Brussels (34, Rue Van Schoor) the Enterprises Générales d'Electricité Belges et Etrangères for the manufacture of and trade in electric cables, insulating tubes, &c.

The Association Industrielle et Technique is the style of a company launched at Brussels (Rue de la Régence) for trade in electrical and mechanical appliances, &c.

Henri Poulain et Cie. has been embodied as a company *en commandite simple* for trade in electrical appliances of all kinds for the undertaking of electrical installations. Offices at Lessines.

Lead.—Messrs. James Forster & Co. reported on March 18th:—"Closing prices yesterday were £21 12s. 6d. for March, and £21 7s. 6d. for June, against £20 17s. 6d. and £20 15s. respectively at the end of last week. The rise is chiefly due to "bear" attempts at covering and reserve in selling by leading interests, and is certainly not due to increased consumptive demand, which, both in the domestic and electrical trades, continues very dull. . . . Germany is reported to be short of lead and stocks very bare. The Board of Trade returns for February are:—Imports, 15,981; exports, 5,325; left for home absorption, 10,656 tons."

Lamp Price Reduction.—A reduction in the price of Royal Ediswan "Kingolite" lamps is announced, amounting to as much as 1s. 9d. per lamp in some cases.

LIGHTING AND POWER NOTES.

Australia.—Victoria.—The Victorian Cabinet has agreed to the extension of the Morwell electricity scheme to certain country districts, beginning with the territory between Geelong and Warrnambool, in the neighbourhood of the railway. The necessary works are being begun forthwith, and will be finished in from 12 to 18 months. The cost will be £160,000.—*Reuter* (Melbourne).

Ayr.—Year's Working.—The annual report of the electrical engineer (Mr. R. Marshall) for the past year records a total revenue to the electricity undertaking of £39,856, as compared with £31,358 in the previous year. Working expenses amounted to £27,089, leaving a gross profit of £12,767. After deduction of interest and sinking fund payments there was a net surplus of £2,896.

Bristol.—Loan.—Application is to be made to the Electricity Commissioners for sanction to a loan of £42,750 for electricity purposes.

Ceylon.—Water Power Scheme.—The Government proposes to combine the waters of two of the head-streams of the Kelani Ganga, about 40 miles from Colombo, and to form a reservoir. It is estimated that electricity to the extent of 200,000 h.p. will be generated. The cost of construction and initial working expenses will amount to nearly £1,000,000.

Continental.—Italy.—Proposals have been submitted for the construction of hydraulic plant to harness the waters of the Upper Natisone River, between Udine and Julian Venetia. The central station would be erected at Stupizza, situated on the banks of the Natisone, south-west of Caporetto, between there and Cividale, in the Province of Udine. The estimated cost of the construction is 20,000,000 lire. The generating station will be the first of its kind in the vicinity. In the Provinces of Venetia and Mantua the Government will also spend 36,000,000 lire upon new hydraulic works, including, among other projects, the Po-Brondolo Canal and the inland waterway between Venice and Milan, *via* Brondolo, Cavanella, the Po River, Cremono, and Lodi.

France.—A scheme is in hand for harnessing the Dordogne River from Vernejoux to Argentat. The proposal includes the erection of several barrages and power stations capable of generating approximately 100,000 h.p., the power being available for agricultural and industrial needs throughout the region of the Centre. The cost of construction will amount to about 400 million francs. Three barrages and three power stations are to be constructed from Vernejoux to Brivesac, giving a total output of 86,000 kW. The first barrage, which is to be built at the point known as "Le Chambon," will be 114 m. high. It is claimed that it will be the highest construction of its kind in the world.—*Reuter's Trade Service* (Paris).

Conway.—Electricity Supply.—The Council has accepted the terms of the North Wales Power Co. for the supply of electricity in bulk, and it is anticipated that the laying of cables and distributing mains will shortly be commenced. Two sub-stations are to be erected.

Crieff.—Electricity Scheme.—The Electricity Commissioners have approved the Town Council's application for an Order to supply the district with electricity, and the matter is to be brought before Parliament.

Drogheda.—Electricity Supply.—The Corporation has re-referred to the Finance Committee a recommendation for public electric lighting. The services of an electrical engineer are to be secured to submit an estimate of the cost, &c.

Galway.—Fire.—The electricity works have been destroyed by fire. The damage is estimated at £15,000.

Grays.—Loan.—The Urban Council has applied to the Electricity Commissioners for sanction to a loan of £5,500 for a turbo-generator and other additional plant.

Hartlepool.—Loan.—The Corporation is applying to the Electricity Commissioners for sanction to a loan of £7,209 for mains and services.

Howth (Co. Dublin).—Electricity Supply.—The Urban Council has decided to proceed with the electricity scheme for the Sutton district.

Hull.—Electricity in Bulk.—The Electricity Committee has agreed to supply electricity in bulk to the Malt Co.'s works at Wincolmlee. The company has guaranteed to take one million units per annum.

India.—Coonoor.—The Municipal Council has under consideration a proposal to supply the district with electricity. The cost of the scheme is estimated at Rs. 2½ lacs, and the charge per unit at 6 annas.

Kidwelly.—Water Power Scheme.—The Council has under consideration a proposal to supply the town with electricity, and it is proposed to utilise the Gwendraeth River for this purpose.

London.—St. Marylebone.—The Borough Council has received the sanction of the Electricity Commissioners to a loan of £15,000 for mains and services.

Hampstead.—The power station is to be closed and the district will receive a supply of electricity from St. Marylebone.

Lydney.—New Power Station.—The Norehard Syndicate, Ltd., have applied to the Electricity Commissioners for permission to erect an electricity generating station adjoining the Norehard Colliery.

Milnrow.—Application for Order.—The Urban District Council has applied to the Electricity Commissioners for a Special Order authorising the Council to generate and distribute electrical energy for public and private purposes.

Portsmouth.—Extension of Supply.—The Corporation has under consideration a proposal to extend its area of electricity supply to Havant and Emsworth. The estimated cost of laying mains and services and providing transformers is £15,800.

Price Reductions.—Reductions in the charges for electricity are to be made in the following districts: Ashton-under-Lyne, Hackney, Ramsgate, St. Marylebone, and St. Pancras.

Storrington.—Public Lighting Rejected.—Two tenders for public lighting were recently submitted to the Parish Council, one from the gas company and the other from Mr. Hecks, who offered to light the streets electrically. The Council, however, decided not to accept either, with the consequence that there is no public lighting.

Stratford-on-Avon.—Extensions.—The Town Council has passed plans for extensions to the works of the electricity company.

Tynemouth.—Year's Working.—The accounts of the Corporation electricity department (Engineer: Mr. C. Turnbull, M.I.E.E.) for the year ended March 31st, 1921, show a total revenue of £52,146, as compared with £34,851 in 1919-20. Working expenditure amounted to £22,846 (£13,642); capital expenditure out of revenue to £9,508 (£7,809); and capital charges to £7,063 (£6,629); leaving a net surplus of £2,895, comparing favourably with a loss of £293 in the preceding period. The number of units sold rose from 5,811,884 to 7,516,571—equal to 104.4 units per head of population. The average selling price was 1.62d. per unit. Referring to the change of system from direct current to three-phase a.c., the Engineer says that this must proceed, as, if the Corporation decides to put down a generating station of its own when the present bulk-supply agreement lapses, an a.c. station would be preferable.

Warrington.—New Sub-station.—The Corporation has received authority from the Electricity Commissioners to borrow the money required for the erection of a sub-station at Stockton Heath.

West Kilbride.—Electricity Supply.—The Ayrshire Northern District Committee has authorised the adoption of electric lighting throughout the district.

TRAMWAY AND RAILWAY NOTES.

Chesterfield.—Extension of Time.—The Minister of Transport has extended the time until May, 1923, of the Chesterfield Corporation Acts, 1913-14, for the completion of the overhead equipment and other apparatus for working trolley vehicles and also for the completion of certain tramways.

Continental.—Italy.—A railway is to be built between Adria and Ariano, in the Province of Rovigo, as soon as the necessary financial arrangements have been made. The distance between the two points is about 15 km., and a bridge is to be built across the Po River, over which the line will pass.—*Reuter's Trade Service* (Rome).

France.—The Union Electrique Régionale has been formed at Civray (Vienne) to carry out the electrification of the lines from Civray to Ruffec and Sauze to Vaussais, and works connected with the production and distribution of electricity.

Spain.—Application has been made to the Government for a concession for the construction and working of an underground electric railway in Barcelona, between the Plaza de Cataluna and the Calle de Gandwen.

Fleetwood.—Track Renewals.—The Urban District Council has recommended to the Blackpool Corporation that several lengths of tramway track in its area be renewed.

Guatemala.—New Electric Railway.—An electric railway is to be constructed in the highlands of Los Altos. Electricity will be generated by hydraulic power. The cost of the scheme is estimated at about £450,000.

Keighley.—Track Renewals.—The Tramways Committee has recommended that application be made to the Ministry of Transport for sanction to borrow £40,000 for the purpose of reconstructing two and a half miles of single track. The Committee also proposes to increase the fares on each stage by 50 per cent.

Llandudno.—Strike.—A consultation between the manager of the Llandudno & Colwyn Bay Electric Railway, Ltd., and men of the permanent way, has resulted in union and non-union men of that section returning to work. There is no change in the situation as regards the drivers and conductors.

London.—Electrification of Suburban Railways.—Agreement has been reached between the members of the Southern Railway Group in the matter of electrification, and the work is to be put in hand almost immediately. The L.B. & S.C. Railway Co. hopes to complete the Balham-Wallington section by the end of the present year. This will effect a considerable improvement in the suburban services and complete a circular route.

The S.E. & C. Railway Co. is to adopt a 1,500-3,000-V three-wire system, using conductor rails, states the *Morning Post*, and the first section of the work will embrace about 94 route miles. The lines marked for early electrification are those to Dartford, Orpington, and Hayes, and a number of loops.

Underground "Speeding-up."—The "Passimeter," which was installed at Kilburn Park station on the Bakerloo Railway three months ago, having proved a success, it has been decided to install similar devices at other tube stations.

Breakdown.—Traffic on practically the whole of the Underground Railway system was held up for nearly half-an-hour on Thursday of last week, owing to the fusing of a switch at the Lots Road power station.

Newcastle-on-Tyne.—Strike Settled.—The strike of the tramway employés, which had lasted for three weeks, was settled last Saturday. A ballot was taken, which showed a large majority in favour of resuming work on the 48-hour instead of the 44-hour basis. The men have been promised full advantages under the National Agreement.

Inquiry.—The Ministry of Transport has given notice that an inquiry will be held on Friday, March 31st, at Newcastle Town Hall into the application of the Corporation to amend the Newcastle-upon-Tyne Corporation Light Railway Order, by the inclusion therein of an additional railway.

Swansea.—Extension of Time.—The Minister of Transport has extended the time of the Swansea Corporation Act for the completion of tramways until August, 1922.

TELEGRAPH AND TELEPHONE NOTES.

France.—Proposed Transfer of Telephone Service.—A Bill has been introduced into the French Chamber to transfer the present State working of the telephones to private hands. The reasons given are that the State has fared badly in the business and that the organisation is wholly antiquated. According to the statements of the opponents of State working, in France there is only one telephone to 143 inhabitants, while in England the ratio is one to 54, in Germany one to 59, and in the United States, one to 8. The connections between the towns, in particular, are in a most defective condition, owing to out-of-date and insufficient equipment. The bad condition of the State's finance precludes the possibility of a thorough reorganisation. It is, therefore, proposed that the organisation should be transferred to a private company, which should be granted a lease of 30 years, the State sharing, with the staff, in the profits.

Guernsey.—Year's Working.—The report upon the working of the States Telephone Department for the year 1921 shows a net profit of £511, the largest yet made; the profit in the previous year was £50. The number of lines increased by 144 to 2,806, but subscribers' and public calls showed a decrease, the total being 1,625,594.

Sweden.—Proposed New Station.—According to *Nya Dagligt Allehanaa*, negotiations with the American Radio Corporation have taken a favourable turn and the Telegraph Board has proposed to the Government to begin the construction of a great radio station, the cost of which is calculated at kr. 5,000,000.—*Reuter's Trade Service* (Stockholm).

Switzerland.—Wireless in the Alps.—It is reported that M. Lacarne has developed special wireless apparatus for installation in the Mont Blanc Observatory. The abnormal atmospheric and weather conditions have made this a difficult task, but M. Lacarne has now established communication between the observatory and the Eiffel Tower, and hopes to extend the system to other parts of the Alps. It has been suggested that this apparatus would be useful in cases of accidents to climbers, as help could be sought from the nearest centre.

The Telephone Service.—Overcharging.—The London Telegraph and Telephone Committee, representing the Chamber of Commerce, the Port of London Authority, the L.C.C., and other bodies, reports that it finds justification for the allegations of overcharging by the G.P.O. for telephone service. Specific cases are quoted, and the worst shows that a subscriber was charged for 3,316 calls when only 2,045 had been made. It is acknowledged that in some cases the fault lies with the subscriber himself, but the Committee thinks that the attention of those who record calls should be drawn to a number of circumstances in which errors may occur. These include the non-notification of the operator in cases of "cut-offs," "wrong numbers," "no reply," &c. The Committee, whilst satisfied that the Department is anxious to ensure accuracy, cannot admit that everything in this direction has been done.

The Times reports that the Association of Chambers of Commerce protests against the arbitrary methods of the Post Office with regard to telephone accounts, many users being charged considerably in excess of the number of calls used without being able to obtain any redress. If the present method of recording calls is essential, it further desires strongly to impress upon the Postmaster-General that greater accuracy be observed.

New London-Manchester Cable.—It is stated that the underground telephone cable from London to Manchester is nearly completed, and it is expected to bring it into service next month. A considerable saving in copper has been effected by equipping the cable with repeaters. At the commencement there will be a temporary repeater station at Leicester, but later permanent stations will be installed at Derby and Fenny Stratford.

New Exchanges.—A move has been made for a new telephone exchange for Bolton as the result of representations to the Postmaster-General that the existing exchange is out of date and not equal to the demands of the town. Strong claims were pressed for an automatic service, but the common battery system was decided upon. Part of the equipment for the new exchange has already been delivered, and a large proportion of the interior and exterior wiring has been completed. During the second half of this year it is expected that Bolton will be fully equipped with a common battery system of telephones.—*Daily Dispatch.*

At a meeting of Newcastle-on-Tyne Rotary Club on the 17th inst., Mr. J. R. M. Elliott, Superintendent-Engineer of Newcastle Post Office, in the course of an address upon "Telephones," gave some interesting information on developments in that district. He described the four systems in use, and said that the latest development, the automatic system, which aimed at the elimination of the operator, had only been installed at one centre in that district, namely, at Darlington. At present there were 15 automatic exchanges in the country, and six additional ones were in course of erection. In Newcastle the necessity for a new exchange, to take the place of the City and Central Exchanges, had been under consideration for some time. A

site was available, and investigations and studies of comparative annual costs were proceeding with a view to determining whether the system to be adopted should be manual or automatic. In the event of the decision being in favour of the latter it would be necessary to convert all the exchanges within a radius of a few miles of Newcastle to automatic also, in order to secure the best results. He mentioned that the busy-hour number of calls in the Newcastle area alone was 11,500. The programme of new underground cables in hand was extensive; in Gateshead 11 miles of new cable was being laid, comprising 1,100 miles of wire; in Newcastle 27 miles of cable, comprising 5,000 miles of wire; and in Wallsend and Walker seven miles of cable, comprising 650 miles of wire, were in hand. Since the war new cable plant had been provided, or was in course of provision, for local development purposes at 42 different centres throughout the district. The total length of cable was 93 miles, and comprised 11,000 miles of wire, the total cost being over £150,000. In connecting up these cables nearly a quarter of a million joints had to be made. A main cable route was being constructed between Newcastle and Durham, and thence to West Hartlepool. The cables contained 5,000 miles of wire, and the cost of the work would be about £142,000. Dealing with long-distance telephony and the use of the thermionic valve repeater, he said that a new cable route had been decided upon between London and Glasgow, having repeater stations at 60-mile intervals. The route in that district would pass *via* Catterick, Darlington, Durham, Newcastle, Otterburn, and Jedburgh. Part of the work was already in progress. A new automatic telephone exchange is to be installed for the eastern district of Hull. This extension of the automatic system is intended to meet demands which the present cable system cannot accommodate.—*Daily Dispatch.*

Proposed Reduction of Charges.—The Select Committee of the House of Commons, which has been investigating several matters relating to the telephone service, has issued its report. The Committee considers that the telephone and telegraph services should be entirely separated, financially, from other Post Office departments, but should remain under the control of the Postmaster-General. With reference to charges, the Committee favours the continuance of the message rate as being much fairer in practice than the flat rate. An immediate reduction in charges of 10 per cent. is recommended, and it is thought that the administrative changes suggested will result in an almost immediate saving of 8 per cent.

Wireless Telegraphy.—South America.—The *Vossische Zeitung* states that in order to avoid the erection of competive wireless stations in Argentina, the German Telefunken Co., whose share capital is held half by the Berlin A.E.G. and half by the Siemens and Halske Co., is transferring a portion of its hitherto dominating holding in the Trans-radio Argentina to the Radio Corporation of America, Marconi's Wireless Telegraph Co., of London, and the Société Générale pour Télégraphie sans Fil. The Trans-radio Argentina is erecting a large wireless station in the vicinity of Buenos Aires, which it is expected will be brought into service in 1923. The *Berliner Tageblatt* says that the Wireless Transmarine Communication Co. (Drahtloser Ueberseeverkehr A.G.), of Berlin, will enter into close relations with the station at Buenos Aires.—*Financial Times.*

Italy.—A German company, having offices in Rome, has acquired the whole of the patent rights of the Telefunken Co. (Germany) for Italy. A plan for the construction of a high-power radio-station has been presented to the Italian Government, which is considering the matter.

Wireless Apparatus in German Schools.—In reply to a complaint made by the *Vossische Zeitung* that the Army of Occupation at Aix-le-Chapelle has seized the wireless apparatus used for teaching purposes in one of the schools for higher education in that town, it is stated that this apparatus was confiscated in accordance with the decision of the Inter-Allied authorities that scholastic establishments on the left bank of the Rhine, though allowed to use wireless apparatus for teaching purposes, must not possess sets capable of receiving or transmitting messages over great distances or having a power of more than six watts. The apparatus in question had a power of 1,000 watts.—*Reuter* (Brussels).

The Telegraph and Telephone Service.—1920-21 Accounts.—The Postmaster-General's financial statement regarding the services for the year ended March 31st, 1921, has been published (H.M. Stationery Office, 6d. net). This shows that telegraph revenue amounted to £5,585,381, expenditure to £8,126,990, and the net deficit to £3,728,779. The equivalent figures for 1919-20 were £5,741,415,, £6,775,930, and £2,636,183 respectively. The telephone service had a revenue of £9,387,531 an expenditure of £10,137,320, and incurred a net loss of £4,721,970. The 1919-20 figures were :—£9,232,063, £7,545,829, and £1,961,710. The Imperial Cable Service earned a profit of £82,213 (£56,217), with a revenue of £239,319 (£208,720). The "Point-to-Point" Wireless Telegraph Service had an income of £749 and incurred a loss of £11,222. The Ship and Shore W.T. Service had a surplus of £6,860; the Anglo-Belgian Telephone Service made a profit of £11,645; and the Anglo-French Telephone Service produced a surplus of £18,575. The net working costs of generating stations were :—Blackfriars, £58,014; and Savings Bank, £5,672.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Ashton-under-Lyne.—April 12th. Electricity Department. Eight 6,600-V equipments. (See this issue.)

Australia.—Melbourne.—May 11th. Victorian Electricity Commissioners. 960 miles of aluminium steel-cored cable; 3,000 lb. flat armoured wire; 4,000 lb. No. 4 tie wire.—*Reuter's Trade Service* (Melbourne).

Brisbane.—April 25th. Met. Water Supply and Sewerage Board. Electrical equipment pumps, and blowers at the Pinkenba pumping station and Luggage Point treatment works, including transformers, motors and blowers, motors and pumps, switchgear, and rotary converter; supply and erection of h.p. aerial transmission line, Breakfast Creek to Luggage Point. Mr. G. Johnston, secretary to the Board, Albert Street, Brisbane.

Bedford.—April 5th. Electricity Department. E.h.p., h.p., and l.p. underground cables for 12 months. (See this issue.)

Belgium.—April 5th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. 1,520 metres of armoured lead-covered, paper-insulated cable and 551 metres of bare lead-covered, paper-insulated cable.

April 10th. Municipal authorities of Esschen (Province of Antwerp). Establishment of an electricity distribution system in the town. Particulars from the Maison Communale, Esschen (Antwerp).

Cheadle and Gatley.—April 3rd. Urban District Council. E.h.p., m.p., and l.p. mains and street lighting accessories. (March 10th.)

Croydon.—March 27th. Electricity Department. Steam-raising plant, consisting of water-tube boiler, &c. (March 10th.)

Douglas (Isle of Man).—April 10th. Corporation. Six miles l.p., three-core, lead-covered cable, distribution pillars, service material, meters, &c. (See this issue.)

Dundee.—April 20th. Electricity Department. One 12-panel d.c. switchboard, four 3,000-amp. d.c. circuit-breaker panels, and three starting panels for rotaries. (See this issue.)

Edinburgh.—April 15th. Electricity Department. Converting plant for lighting and traction, and d.c. switchgear, for the Portobello station. (March 10th.)

Hove.—March 31st. Electricity Department. L.p. feeder switchboard. (March 17th.)

India.—March 31st. High Commissioner of India. Electric cable. (March 17th.)

April 7th. Inert electric cells, Leclanché cells and spare parts.

Kettering.—March 27th. Electricity Department. Two feeder cables. (March 17th.)

Liverpool.—March 27th. West Derby Union. Electrical supplies for three months. Mr. H. P. Cleaver, Union Offices, Brougham Terrace, Liverpool.

London.—L.C.C.—April 10th. Ash conveyor of the water-immersed, drag-link type, and ash hopper for the Greenwich power station. (March 10th.)

March 27th. Wiring and fitting for electric lighting and power at the Stamford Hill Stores Depôt. (March 17th.)

Lambeth.—March 28th. Board of Guardians. Installation of an electric lift and dismantling and removal of existing lift at the Infirmary. Mr. J. L. Goldspink, clerk to the Guardians, Guardians' Offices, Brook Street, Kennington Road, S.E.

Wandsworth.—April 12th. Board of Guardians. Installation of electric lighting and fire alarms at the Swaffield Road Schools. (See this issue.)

Loughborough.—April 14th. Electricity Department. E.h.p. switchgear, and extensions to d.c. switchgear. (See this issue.)

Rosslynlee.—Midlothian and Peebles District Asylum. Stores for six months, including electric fittings. Clerk and Treasurer, 19, Heriot Row, Edinburgh.

Salford.—Tramways Department. Top covers for six tramcars. General manager, Tramways Department, 32, Blackfriars Street, Salford.

South Africa.—Durban.—April 19th. Corporation. Supply of consumers' meters, &c. (see Elec. Rev., December 30th, p. 892). The closing date for tenders has been extended to April 19th. Firms not represented in South Africa are advised by the Department of Overseas Trade to forward tenders as soon as possible to Messrs. Webster, Steel & Co., 5, East India Avenue, E.C.3, the agents of the Corporation.*

Johannesburg.—April 12th. Municipal Council. 15 miles 0000 S.W.G., .4 in., round section, H.D. trolley wire.*

Six 3,000-3,300-V cubicles*

Spain.—The Board of Works of the port of Gijón has invited tenders for three 3-ton electric cranes, the estimated cost of which is 351,000 pesetas.

April 29th. Harbour Works Authorities, Alicante. Three electrically-operated cranes. Particulars from La Junta de Obras del Puerto, Alicante.

Walthamstow. — April 12th. Electricity Department. E.h.p. feeder cable and l.p. distributor and public lighting cables. (See this issue.)

Warrington.—March 28th. Board of Guardians. Electrical goods for three months. A. Bottomley, clerk, Bewsey Chambers.

Wolverhampton.—April 12th. Board of Guardians. electric lighting installation at the Institution, Heath Town. (See this issue.)

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*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—Melbourne. City Council. Accepted:—
Oil switches, £481.—Electric Equipment Co.
Isolating switches, £101.—Tombs & Howcroft Pty., Ltd.
3,000 gas-filled lamps, £1,350.—British General Electric Co., Ltd.
In connection with the tender of Messrs. Lawrence & Hanson for 3,000 gasfilled lamps at £1,212 (see Elec. Rev., January 20th, p. 96), the firm has informed the Council that owing to an error it is unable to execute the contract.
Two Edison-type electric-vehicle batteries, £631.—Tombs & Howcroft Pty., Ltd.
Reason electricity meters, £432.—W. G. Watson & Co., Ltd.
Two 2,000-amp. isolating switches, £340.—Met.-Vickers Electrical Co., Ltd. —*Tenders.*

Sydney.—City Council. Accepted:—
Fuse boxes and fuses, £2,250.—English Elec. Co. of Australia, Ltd.

Berkshire.—County Mental Hospital Committee. Accepted:—
Reinstatement of the electric wiring and installation at the hospital, £5,862. —Mr. Wheeler.

Blackpool.—By a printer's error in our last issue two items from our Blackpool "Contract Closed" entry fell down into the "Bradford" paragraph. The one 1,000-kW rotary converter and the two 300-kW ditto were ordered by the Blackpool Tramways Committee.

Chester.—Electricity Committee. Accepted:—
Switchgear in connection with the supply of electricity to Hoole, £915.—Metropolitan-Vickers Elec. Co., Ltd.

Denny (Stirlingshire).—Messrs. Malcolm & Allan have secured the contract for an electric lighting installation at the parish church.

Dover.—Town Council. Accepted:—
Electric wiring at the Isolation Hospital, £103.—Mr. J. Martin.

Edinburgh.—Corporation. Accepted:—
Supply of time switches.—Venner Time Switches, Ltd.

Eston.—Urban District Council. Messrs. Clough, Smith and Co., Ltd., have received the contract for the supply and erection of the overhead equipment comprising 700 poles, &c., and the supply and laying of about 4½ miles of underground mains, in connection with the town lighting of South Bank, Grangetown, Normanby and Teesville.

France.—The French Thomson-Houston Co. is reported to have obtained an order for 1,000 dynamos for the French State Railways for train lighting.—*Exchange Telegraph* (Antwerp).

Glasgow.—Tramway Department. Recommended:—
E.h.p. cable (lead covered) for Pinkston power station.—Hackbridge Cable Co., Ltd.
Switches, for Parkhead depôt.—English Electric and Siemens' Supplies, Ltd.

Corporation. Accepted:—
Electrical installation at 750 houses in connection with the Mosspark housing scheme, £8,933, subject to the approval of the Scottish Board of Health.—R. J. Sinclair.

Government Contracts.—The following new Government contracts were placed during February, 1922:—

Admiralty Contract and Purchase Department.
Boiler-house equipment.—Ruston & Hornsby, Ltd.
Underground supply cables.—Foote, Milne & Co.
Electric traveller.—Stothert & Pitt, Ltd.
Electrodes.—Quasi-Arc Co., Ltd.; Alloy Welding Processes, Ltd.
Magnetic collision mat.—General Electric Co., Ltd.
L.p. switchboards.—Whipp & Bourne, Ltd.
Portable resistance testing sets.—Everett, Edgcumbe & Co., Ltd.
Rewinding armatures of electric generators.—W. H. Allen, Sons & Co., Ltd.
Carbon drive and circulating motors and spare parts.—Jas. Keith & Blackman Co., Ltd.

War Office.
Electric cable.—Siemens Bros. & Co., Ltd.
Electrical equipment.—English Electric Co., Ltd.
Electric fans.—General Electric Co., Ltd.
Generator repairs.—English Electric Co., Ltd.
Switchboards.—Drake & Gorham, Ltd.

Air Ministry.
Amplifiers.—Marconi Scientific Instrument Co., Ltd.
Condensers.—Gambrell Bros., Ltd.
Engine-driven pumps.—Rees Roturbo Manufacturing Co., Ltd.
Valves.—General Electric Co., Ltd.

Post Office.
Telephone apparatus.—General Electric Co., Ltd. (Peel-Conner Telephone Works); Western Electric Co., Ltd.
Testing, protective apparatus, &c.—Cambridge & Paul Instrument Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Western Electric Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—Enfield Ediswan Cable Works, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.
Jointing sleeves.—Dugard Bros., Ltd.
Laying conduits.—Additional contracts for laying conduits in London and different parts of the country were placed during the month.
Lifts.—Waterloo Street Parcels Office: A. & P. Stevens.
Manufacture, supply, drawing-in, and jointing cable.—Waltham Cross-Bishop's Stortford: Johnson & Phillips, Ltd. Oldham-Huddersfield-Halifax: Pirelli-General Cable Works, Ltd. Stanmore-Chesham: Siemens Bros. & Co., Ltd. Walsall-Wolverhampton-Wednesbury-Willenhall: British Insulated & Helsby Cables, Ltd.
Pneumatic telephone docket distributing tubes.—London Trunk Exchange, G.P.O. (S.): Western Electric Co., Ltd.

H.M. Office of Works.
Engineering services.—Bethnal Green houses, electric wiring: Tredegars, Ltd. Frimley sanatorium, electric wiring: Alpha Manufacturing Co., Ltd. Teddington Laboratory, electric lift: W. Wadsworth & Sons. Storage battery: Chloride Electrical Storage Co., Ltd. Cable, &c.: Hackbridge Cable Co., Ltd.; Enfield Ediswan Cable Works, Ltd.

Crown Agents for the Colonies.
Battery material.—Pritchett & Gold & E.P.S. Co., Ltd.
Switchgear.—Metropolitan-Vickers Electrical Co., Ltd.
Telephones.—Phonopore Construction Co., Ltd.
X-ray outfits.—Cox Cavendish Electric Co., Ltd.

Commissioners of Public Works, Dublin.
Installation of electric lighting plant, Leopardstown Park Hospital.—Handley & Robinson, Ltd.

London.—St. Pancras.—Electricity and Public Lighting Committee. Coal for the Electricity Department:—
2,000 tons Bentinck ¾ in. nutty slack, 23s. 2d. per ton; 500 tons 1 in. hard nutty slack, 22s. 5d. per ton; 500 tons Ramcroft hards, 35s. 6d. per ton.—J. H. Beattie & Co., Ltd. (accepted).
Ash-handling plant for King's Road station, £2,555.—Underfeed Stoker Co., Ltd. (recommended).

Stepney.—Electricity Committee.
Supply of electricity to the Wapping hydraulic power station. Meters, £166.—A. Reyrolle & Co., Ltd. (recommended).

Fulham.—Electricity and Lighting Committee.—The Committee recommends the Council to authorise the acceptance by the Hammersmith B.C. of the tender of the Pirelli-General Cable Works of £5,065 for the cable required for the duplicate main in connection with the linking-up scheme.

Water-circulating system:—
Excavation work and erection of a reinforced concrete sump-screening well and culvert, £4,487.—Cochrane & Son, Ltd. (recommended).
Revolving screen with driving motor, cable, and connections, £1,513.—F. W. Brackett & Co., Ltd. (recommended).

Hammersmith. — Electricity Committee. Recommended (annual contracts):—
Stoneware conduit (£175).—Albion Clay Co., Ltd.
Insulated wires (£141).—Enfield Ediswan Cable Works, Ltd.
Draw boxes, frames and covers (£320).—W. Lucy & Co., Ltd.

Stoke Newington.—Electric Lighting Committee. Recommended:—
Spare parts for e.h.p. switchboard (£109).—General Electric Co., Ltd.

Hackney.—Public Health Committee. Accepted:—
Mechanical clinker loader, £630.—Ransomes & Rapier, Ltd.

Kensington.—Borough Council. Recommended:—
Installation of electricity at the Town Hall, £925.—Rawlings Bros., Ltd.

New Zealand.—With further reference to our note on page 57, Elec. Rev., January 13th, below we now publish from *Tenders* further particulars of the tenders accepted by the Public Works Committee in connection with the Mangahao hydro-electric power scheme:—
Seven 4,000-kVA transformers (British manufacture), £16,574.—A. D. Riley & Co.
Three 6,450-b.h.p. and two 3,250-b.h.p. waterwheels, £23,795.—Boving and Co.
Three 6,000-kVA and two 3,000-kVA generators, £54,967.—Met.-Vickers Electrical Co.
Delivery is to be made within 15 months.

The contract for the supply of the steel pipe-line for the Waikaremoana hydro-electric power plant is, states *Tenders*, being carried out by Messrs. Cory-Wright & Salmon, of Wellington, N.Z., at a cost of £12,510, and is now approaching completion.

Stockton-on-Tees.—Electricity Committee. Accepted:—
E.h.p., l.p., and pilot cables, £2,969.—British Insulated & Helsby Cables, Ltd.

The Still Engine.—In a paper read before the Institute of Marine Engineers (Inc.) on March 14th, Mr. F. L. Martineau stated that the Still system could be applied to any type of internal-combustion engine by the modification of a few details, with a resulting increase in output with the same fuel consumption. Whereas the Diesel engine could only convert 31 per cent. of the heat value of the fuel into useful work, by changing it to the Still system, the proportion could be raised to 40 per cent.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturday, March 25th. At Albemarle Street, W. At 3 p.m. Lecture on "Radio-activity," by Sir E. Rutherford, F.R.S. (Lecture IV.).

Electrical Power Engineers' Association (Kent Section).—Saturday, March 25th. At the Church Institute, Maidstone. At 6.30 p.m. Lecture on "Petroleum: its Insulating and Lubricating Power," by Mr. E. A. Evans.

Illuminating Engineering Society.—Tuesday, March 28th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Joint discussion with the Royal Institute of British Architects on "The Lighting of Public Buildings; Scientific Methods and Architectural Requirements."

Nottingham Society of Engineers.—Wednesday, March 29th. At the Welbeck Hotel. At 7 p.m. Paper on "The X-ray Examination of Materials," by Mr. J. F. Driver.

Industrial League and Council.—Wednesday, March 29th. At Caxton Hall, S.W.1. At 7.30 p.m. Lecture on "The Necessity for Educating the Worker in Industrial Economics," by Major I. Salmon.

Institution of Electrical Engineers.—Thursday, March 30th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Applications of Electricity to Agriculture," by Mr. R Borlase Matthews.

(North-Eastern Centre).—Monday, March 27th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "Protective Apparatus for Turbo-Alternators," by Mr. J. A. Kuyser.

(North-Midland Centre).—Tuesday, March 28th. At the Hotel Metropole, Leeds. At 7 p.m. Paper on "Protective Apparatus for Turbo-Alternators," by Mr. J. A. Kuyser.

(East-Midland Sub-Centre).—Tuesday, March 28th. At The College, Loughborough. At 6.45 p.m. Paper on "The Future of Power Generation," by Mr. A. H. Seabrook.

(North-Western Students' Centre).—Tuesday, March 28th. At the Houldsworth Hall, Deansgate, Manchester. At 7.30 p.m. Address by the Chairman of the N.W. Centre (Mr. W. Walker).

Chemical Society.—Thursday, March 30th. At Burlington House, Piccadilly, W. At 4.30 p.m. Presidential address by Sir James Walker, F.R.S. 8 p.m. Informal meeting.

Institution of Mechanical Engineers.—Friday, March 31st. At the Institution, Storey's Gate, S.W. At 6 p.m. Paper on "The Milling of Screws, and Other Problems in the Theory of Screw-threads," by Prof. H. H. Jeffcoat.

Junior Institution of Engineers.—Friday, March 31st. At Caxton Hall, S.W. At 8 p.m. Lecturette, "The Steel-smelting Shop," by Mr. D. P. Dickinson.

Batti-Wallahs' Society.—Friday, March 31st. At the Holborn Restaurant, W.C. At 7 p.m. Eleventh annual dinner (ladies' night).

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of suppliers or manufacturers of:—

Ferrilite Illumination strip holders.
Banbury electric heaters.
Roland-Wilde fuel calorimeter.
Pascarella electrolier (used chiefly for railway work).

NOTES.

Bradford Electrical Contractors' Dinner.—The fourth annual dinner of the Bradford branch of the National Federated Electrical Association took place on March 17th. Mr. Armistead Smith presided over a large attendance, and the visitors included representatives of the municipal electricity authority, manufacturers of electrical appliances, and wholesalers and factors. Mr. Percy Collinson (ex-president of the Bradford branch and of the National Association, supporting the toast of the N.F.E.A.,, proposed by Mr. L. W. Douthwaite, said the great difficulty the contractors had always been up against as contractors had been to come to an understanding with electricity supply authorities and manufacturers. There were even yet electricity undertakings which were not content with their legitimate function, but insisted on entering into competition with the contractors. He believed there was now a much better spirit and that full understanding would soon be reached. The municipal engineers declared that there was a distinct demand for the hire-purchase system in motors, and in the near future it would be essential for contractors to formulate a hire-purchase scheme, or they could no longer stand in the way of the municipal engineer doing it. Mr. Collinson said he believed this was about the only stumbling block now to a definite understanding, and he hoped it would soon be removed. When he had asked manufacturers why they could not see their way to put the contractors on a fairer basis, they replied: "Well, why should we? You presumably are claiming these discounts because you are retailers. Where are your showrooms? Where is your publicity? Are you pushing the goods enough?" The manufacturer was prepared to do anything for anybody who was going to help to sell his goods, but the contractor was looked upon as not doing his best. Mr. Collinson said his own reply had always been: "Whilst you feed the contractor on skimmed milk he cannot afford greater showroom and publicity facilities and more travellers." This question of showrooms, however, was certainly a very vital one. In Bradford they had a municipal showroom, and Mr. Collinson believed the contractors had a good working arrangement with that department, but it was a question whether that showroom in itself was adequate, and whether the individual contractors should not have showrooms also; it was a question whether they should not co-operate either with the existing showroom or with each other for a showroom of their own. The chairman, responding, said in Bradford the contractors were already in negotiation with the municipal department with a view to a publicity campaign. It might be only a comparatively small beginning, but they hoped it would grow. Mr. L. Jessop, proposing "The Guests," said the members were glad to welcome the visitors, amongst whom they had Mr. Thos. Roles (the city electrical engineer), Mr. C. E. Allsop (the sales manager to the department), Messrs. Barnett and Parker (as representing the consumers' department of the trade), Messrs. Douthwaite and Dyson (for the wholesalers and factors), representatives of the Metropolitan Vickers Co. and the General Electric Co. (for the general manufacturers), representatives of Messrs. Henley and the Liverpool Cable Co. (for cable manufacturers), and also contractors who were not members of the Federation.

Mr. Thos. Roles, responding, said he had always recognised the contractors as very important auxiliaries to the electricity supply department; all branches of the trade must pull together. The Association was for the good of the electrical business, and he considered that there was no city in the country in which there was a better class of electrical work done than Bradford. There was a feeling that the contractors were not doing everything they could do to foster the latent demand. He doubted whether contractors fully appreciated the great extent of that prospective demand, and as an illustration he instanced the immense use of electricity for domestic purposes in America. The time would come when there would be very few good houses of £25 per year or so rental without an electric washing and ironing outfit. The Bradford Corporation did not want to do the direct selling to the public if the contractors would do it. The Corporation wanted to sell electricity. As to co-operation for showrooms, when the Corporation showroom was put in hand, he had himself stated that if the contractors would run a co-operative showroom he would ask the Corporation not to proceed. In the matter of the price of energy, they would have to have an output of some fifteen million units to effect a material reduction, and the department would be thankful for the contractors' help.

Mr. Smith (General Electric Co., Ltd.), Leeds office, said that if the contractors could grip the suggestion made by Mr. Collinson, it would be a great step forward. The average consumer did not know what could be done electrically, and it was up to the contractors to let him know.

In the course of the evening an enjoyable programme of music and humorous monologue was provided by Messrs. T. Ackroyd, W. D. Wilson, L. Bacon, A. C. Loxley, and A. Frillinghouse, all members of the branch.

Appointments Vacant.—Plumber-jointer for the City of Carlisle Electricity Department; the Manchester Corporation is inviting applications for the position of General Manager of its tramway undertaking. (See our advertisement columns to-day.)

The Language of Science.—Scientific reports do not often provide humorous reading, but the following comparison will show that this quality, even if unintentional, is not always lacking. Giambattista Porta, a Neapolitan philosopher who died in 1615, was requested to report his views on the lodestone, which he did as follows.

"I think the lodestone is a mixture of stone and iron, as an iron stone or a stone of iron. Yet do not think the stone is so changed into iron as to lose its own nature nor that the iron is so drowned in the stone but it preserves itself; and whilst one labours to get the victory of the other the attraction is made by the combat between them. In that body there is more of the stone than of iron, and therefore the iron, that it may not be subdued by the stone, desires the force and company of iron; that not being able to resist alone, it may be able by more help to defend itself. For all creatures defend their being; wherefore that it may enjoy friendly help and not lose its own perfection it willingly draws iron to it, or iron willingly comes to that."

More than three hundred years later, that is, early last year, a University professor, giving evidence before a Parliamentary Committee on fuel supply, was reported as saying:—

"In the main it is correct, but not scientifically correct. My talk might be criticised, part of this, in the analysis of coal. In analysing coal, called proximate analysis, coal is generally analysed for moisture, volatile combustion, fixed carbon and ash. Now the moisture in this coal is not the moisture that would appear in a piece of coal, but it is contained in the coal. This moisture is driven off your coal in your analysis as practically boiling water. Volatile combustibles comprise various constituents. Your fixed carbon is the remaining carbon contained in the ash. Following that, we know that the general accepted classification of coal in the lowest form is lignite, next bituminous, and next, generally speaking, is an anthracite. The classification of coal is a very difficult subject, and everybody who knows anything about classification of coal has a different idea from another man, but, generally speaking, between lignite and bituminous the distinction is in the moisture content of your coal."

How delighted he must have been when he read this effusion. One cannot help wondering what he really did say!

H. Williamson,
Member Faraday Society.

London County Council Committees.—The following Committees have been appointed for the year 1922-23:—

Highways Committee.—Mr. D. Davies, Mr. B. F. Galer, Mr. T. C. E. Goff, Earl of Haddo, Mr. G. H. Hume, Mr. E. H. Kemp, Lt.-Col. A. C. H. Kennard, Mr. S. March, Mr. C. W. Mattnews, Mr. W. J. Morton, Mr. J. Osborn, Miss R. M. Parsons, Capt. G. E. Pierrepoint, Mr. F. W. Raffety, Mr. A. N. Scott, Capt. O. Wakeman, Mr. H. Ward, and Mr. W. J. Webb.

Stores and Contracts Committee.—Lt.-Col. E. Ball, Sir J. Benn, Bart., Mr. J. G. Butler, Mr. D. Cawdron, Mr. E. Cruse, Mr. D. Davies, Mr. F. Holmes, Mr. W. Hunt, Mr. W. C. Johnson, Mr. W. J. Pincombe, Sir L. Pound, Bart., Mr. P. H. Reed, and Major I. Salmon.

London Electricity Supply Committee.—Mr. E. M. Dence, Mr. P. A. Harris, Mr. G. H. Hume, Sir C. Jackson, Mr. H. Mills, Lord Monk-Bretton, Mr. H. Morrison, Mr. O. W. Nicholson, Mr. R. C. Norman, Miss R. M. Parsons, Major I. Salmon, Mr. E. Sanger, Mr. H. Ward, and Mr. W. J. Webb.

Electric Arc Welding.—The object of Mr. A. T. Wall's paper on the subject of "Electric Welding Applied to Steel Construction, with Special Reference to Ships," which he read to members of the Institution of Mechanical Engineers last month, is to call attention to the various ways in which electric welding is being applied to ship construction, and to indicate further possibilities in this connection for steel structures. Reference is also made to the necessity for taking reasonable precautions in carrying out this work. Electric welding is now approved by registration societies for the survey of shipping, for strength parts of a ship structure. This may be said to be the greatest step made in this branch of industry, and it has demonstrated that an electrically-welded vessel can carry out successfully the work of a sea-going carrier.

The author considers that there is very ample scope for the application of electric welding to the structure of a ship, or to any other steel structure. It would result in more efficient structures because of better joints with less material. If judiciously applied, the cost need not be greater than with riveting. This is especially true if the increased earning capacity of a vessel, due to increased deadweight is taken into account, since first cost is by no means the only consideration. It would be expected that there should also be a reduced upkeep cost. The saving of weight is of particular value in warships and high-speed merchant vessels, because the horse-power required to propel them can be considerably reduced. This saving of weight is also important in any structure which has to carry its own weight. A welded structure is more homogeneous than a riveted one. Further experience would appear to be necessary before saying definitely that, in a combination of riveted and welded joints, the greater slip of the riveted joints after the stress exceeds its elastic slip value would throw all the stress on to the welded joints; but in any case such a contingency should be avoided, because it would appear to be unwise to stress a riveted joint beyond its elastic slip value.

With regard to the ultimate extensibility and contraction of area of a butt-welded mild-steel piece, these are not as great as in a plain piece of mild steel. This would not appear to be a drawback, because the extensibility of the weld at its breaking point is about sixty times its extensibility at the yield point, giving a good margin. If, in the future, steel is produced for structural work with higher mechanical qualities than the present mild steel, it follows from what the author says about riveted joints that riveting will not give the extra strength commensurate with the better steel, and welding appears to present the best and probably the only solution. Spot or resistance welding is dangerous in structural work, because an oxide line must of necessity be produced at the junction between the two surfaces, and the unwelded portions act as leading cracks, causing failure through the oxide line.

All that has been stated has been based on the assumption that the welding has been properly carried out. Good welding depends on the use of an efficient electrode and a capable and conscientious welder. The first condition can easily be met by specification and test. Lloyd's Register, and it is believed the British Admiralty, have already framed tests which would satisfy them. Without doubt welders should receive specialised training and should be morally incapable of doing scamped work or covering up bad work. It is now recognised by many practical shipbuilders that there are great possibilities in electric welding.

Commercial Electrolytic Iron.—A process of producing commercially electrolytic iron that has been developed in France is described in the *Iron and Coal Trades Review* as consisting of the electrolysing of a concentrated solution of ferrous chloride at a temperature of 75 deg. C. Cast-iron soluble anodes are used and a rotating steel mandrel forms the cathode; a current density of 1,000 A per sq. m. is employed, and a deposition of dense, smooth iron of any desired thickness is obtained by the use of depolarisers. Moreover, there is no irregularity of wall thickness in tubes made by the process. Sulphide ores are mostly employed, and a new use is therefore found for the most abundant, and correspondingly cheap, American pyrrhotite ore. The National Tube Co.'s tests resulted in a yield point of 52,000 lb. of iron deposited per sq. in., the scleroscope hardness of 27 falling to 11 upon re-heating, and the Brinell hardness of 158 to 54, the elongation being 12 per cent. on an 8-in. strip.

The Batti-Wallahs' Society.—This Society held its annual general meeting at the Holborn Restaurant on Monday last, when a goodly and representative gathering was presided over by Mr. W. E. Ireland, the retiring president. Mr. Pooley, who has been the hon. secretary for the past twelve years, and Mr. A. J. Greenly, the hon. entertainment secretary, both of whom wished to retire, but felt unable to do so while the Society's affairs languished, now relinquish their posts. They are succeeded by Mr. M. Whitgift as hon. secretary, and Mr. E. G. Batt as hon. entertainment secretary. Mr. Edgar Barralet is the new president, with a strong committee, and it has been resolved that the festive meetings shall now be recommenced, and an active season is in contemplation. The committee for 1922 is:—Messrs. A. W. Blake, Leslie Dixon, M. R. Gardner, R. Grierson, A. F. Harmer, and L. S. Richardson, with officers as above.

Service Notes.—Lieut. C. G. Ommaney has been appointed to the battle-cruiser *Hood*, flagship of the Atlantic Fleet, as Squadron W.T. officer. Captain F. H. Masters, C.B.E., T.D., A.M.I.E.E., from the London Electrical Engineers, has been promoted major in the general list of the Reserve of Officers of the Royal Engineers. Major K. W. E. Edgcumbe, T.D., M.Inst.C.E., M.I.E.E., has relinquished his commission in the London Electrical Engineers, retaining his rank, with permission to wear the prescribed uniform.

Miners' Welfare Fund.—The committee appointed by the Secretary for Mines to allocate the fund constituted under Section 20 of the Mining Industry Act, 1920, has voted £12,000 to provide for important research work in connection with (*a*) miners' safety lamps, both flame and electric, and (*b*) coal dust dangers; and also the preparation of abstracts of research data both in this country and abroad. £1,000 was voted towards research in connection with the control of atmospheric conditions in deep and hot mines. All these research activities will be carried on under the supervision of the Mines Department.

Synchronisation of Kinema Film and Voice.—A demonstration was given, on March 3rd, at the Albert Hall, Leeds, of the invention of Mr. Claude H. Verity for the synchronisation of film and voice in kinematograph productions. By experiment over a considerable time past, Mr. Verity has produced an apparatus which certainly yields co-timing of the lip movements of persons on the screen with the sounds emitted from the electrically-controlled gramophone, although the typical defects of gramophone rendering, the scraping, the harshness and, at times, indistinctness of words, are enhanced by the amplifier horns which have to be used, in conjunction with a microphone attachment, in order to spread the sound over a large building. Mr. Verity put his apparatus under a very severe test, having engaged a large hall, the acoustic properties of which are by no means of the best. The sounds reverberated considerably, also because, being a private view, by invitation, there was a comparatively small audience in proportion to the size of the place. The problem which Mr. Verity has yet to face is that of securing clarity of vocal enunciation whilst retaining tonal volume. The Verity system of synchronisation is based on complete electrical harmony between the projector, at one end of the hall, and the gramophone behind the screen at the other end. Attached to the projector is a revolution counter, and there is also a commutator for electrically operating the counter attached to the gramophone. The spindle on which this is mounted has attached to it a rotating contact which operates a parallel row of lights. At the gramophone end a second row of parallel lights is controlled by a similar contact maker. There is also a revolution counter showing the revolutions of the gramophone turn-table and working in conjunction with the rotating contact. The film is consecutively numbered to correspond with the numbers shown on the revolution counter attached to the projector. By this combination, each of which is essential to the other, it is possible to synchronise the gramophone and the projector so that for any length of time they do not vary more than one-twenty-fourth of a second. In case of the break of the film it can be re-set, so that on starting up the machines, synchronisation is continued. Owing to each section of the film being numbered consecutively, it is possible to detect at a glance if a single picture of any section of film is missing or damaged, and black spacing is then inserted so that the film is always the same length until a fresh section can be secured. An automatic testing machine is employed for testing and showing if one picture is missing at any portion of the film.

A company is shortly to be formed to place the Verity invention on the market. A public show of three weeks' duration is to be given at the Albert Hall, Leeds, commencing April 3rd. Mr. Verity is a native of Leeds, and has an office at 168, Briggate.

The Wimbledon Case.—As we go to press we learn that on Monday next, at 8 p.m., the Town Council will consider a resolution to appoint Mr. A. E. McKenzie, M.I.E.E. (of the staff of Messrs. Sparks & Partners), chief electrical engineer to the Council, at a salary of £1,000 a year, as from June 1st.

A Transmission Line Dinner.—The landowners and farmers in the Amman Valley, over whose land the Swansea Corporation Electricity Department's new overhead transmission line to the Amman Valley has been erected, were entertained to dinner at the Hotel Metropole, Swansea, on Friday last, by Messrs. Callender's Cable & Construction Co., Ltd., who carried out the work. The line extends 16½ miles from the sub-station at Manselton, Swansea, to the sub-station at Gelliceidrin colliery, Brynamman, and there are three transmission lines and an earth line carried on 158 poles. The route followed is over the Gellionen mountain, via the Clydach Valley, into the Amman Valley, and a tapping tower is to be erected on the mountain for an extension into Clydach. Contracts have already been entered into with three collieries for the consumption of about four million units, and negotiations are proceeding with other colliery undertakings. The bulk of the requirements of the Gorseinon Electric Lighting Co., will also be supplied by means of this extension. The Swansea borough electrical engineer, Mr. G. W. Burr, presided over the dinner. Mr. Foulds, secretary of Messrs. Callender's, in proposing the toast of "The Swansea Corporation," pointed out that in extending the line beyond the borough the Corporation had undoubtedly given a great advantage to the outlying districts. Mr. Worsdell, of Messrs. Callender's, proposed "The Electricity Committee," and Lieut-Col. A. Sinclair, the chairman, in reply, emphasised the advantages which the farmers might derive from this transmission line for agricultural purposes. The toast of "Messrs. Callenders," proposed by the vice-chairman of the Electricity Committee, Mr. George Colwell, was responded to by Mr. Foulds.

Glasgow's Labour-saving Houses.—We regret that by a slip in transcription, in the last paragraph on page 296, the words "2½ million kWh" were inserted instead of "2½ thousand million kWh."

Cable Charts and Cable Calculations.—The article on this subject which we published in our last issue has attracted the attention of Messrs. Drake & Gorham, Ltd., who have sent us a specimen copy of a pocket "Voltage-Drop Calculator" based on the alignment principle which they have had in hand for some months and are about to issue. This is a very ingenious and useful contrivance; the scales are so chosen that the same graduations do duty twice over, and the whole thing measures less than 6¼ by 4¼ inches when closed. For convenience in use, a reference line on celluloid, rotating on a sliding centre, is provided. The device is thoroughly practical, direct reading, and just the thing for the pocket.

The Electrical Wholesalers' Federation, Ltd.—The March meeting of the Council of the E.W.F. was held in Birmingham recently, at the invitation of the members of the Midland Section. At the election of officers, Mr. A. G. Beaver (Sun Electrical Co., Ltd., London) was unanimously elected to occupy the presidential chair for the ensuing year 1922-3, and Mr. A. Holman (Holman & Co., Glasgow) was elected vice-president. The members of the Federation were specially invited to the British Industries Fair at Birmingham, and were entertained at lunch by members of the Executive Council and the electrical exhibitors.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—Informal Meeting.—On March 6th Mr. E. Ambrose opened a discussion on the testing of e.h.p. cables. Mr. Ambrose described in detail the latest form of the Delon testing apparatus; his remarks were mainly confined to the problems arising with potentials of from 20,000 to 30,000 V and upwards on cables of considerable length. He pointed out the failure of the ordinary loop and fall-of-potential methods for finding a fault of, say 100,000 ohms resistance on a long feeder. He also spoke of the tendency of the dielectric to melt and seal a fault under testing.

In the ensuing discussion Mr. W. E. Rogers, speaking from experience limited to medium pressures, thought that faults were generally self-evident and arose at joints or terminals.

Mr. A. F. N. Richards, Dr. R. D. Gifford, and Mr. E. F. Hetherington spoke next. Mr. C. Grover drew attention to the danger of quickly charging a cable under test and the importance of slowly discharging it. A charge would accumulate in a cable for some time after it had been disconnected, and it was often important to leave it earthed for many hours.

Mr. P. Dunsheath drew a diagram of a method of testing he had used before the Delon set came to his aid.

Messrs. C. A. Newell, A. G. Hilling, and O. L. Record followed, and then Mr. G. L. Addenbrooke spoke of the need for more attention to this subject. Cables cost about half the total outlay on an electrical system, but through not being as spectacular as the superstructure and machines they got little or no consideration except from the people whose duty it was to maintain them. Mr. W. E. Bradshaw and Mr. A. G. Kennedy were followed by Mr. J. B. Spark, who outlined a single drop-of-potential method he had evolved. Mr. Ambrose, in conclusion, reviewed the points raised and the meeting accorded him a vote of thanks.

North-Western Centre.—There was a very large gathering of the members and their friends at the Manchester Municipal College of Technology on March 20th to witness an exhibition of kinematograph films, two of the subjects being "Telephone Inventions of To-day" and "Electricity in the Home," exhibited by Mr. F. Gill. Mr. P. Torchio's film showing tests on oil switches was exhibited by Dr. C. C. Garrard.

Summer Meeting.—The programme for the Institution's Summer Meeting is substantially the same as that arranged for last year, but abandoned on account of the coal strike. The first two days (May 30th and 31st) will be spent in Glasgow, and visits will be paid to the Dalmarnock power station and a number of works. Excursions to Fort William and Kinlochleven are being arranged on June 1st and 2nd. Members wishing to participate are asked to communicate with the Secretary of the Institution before March 31st.

North-Eastern Centre.—It had been arranged that the president (Mr. J. S. Highfield) should give an address upon "The Primary and Secondary Education of Engineers" at the meeting of the Centre on March 13th, but he was prevented from attending by ill-health. Mr. J. R. Beard delivered a lecture on his American impressions.

Liverpool Sub-Centre.—The paper by Messrs. L. J. Romero and J. B. Palmer on the "Interconnection of a.c. Power Stations" was read before the Sub-Centre on March 20th. The discussion was opened by Mr. Morton, who was followed by Dr. Marchant, Mr. Breach, Mr. L. B. Wilson, Mr. H. Midgley, Mr. Malpas, Mr. Rettie, and Mr. Dickinson. Mr. Romero replied to the discussion.

Institution of Civil Engineers.—On March 21st, at an ordinary meeting of the Institution, Mr. W. Willox, M.A., read a paper on "All-Electric Automatic Power Signaling on the Metropolitan Railway." The author traced the growth of the system from 1909 to the present time and estimated the saving in wages at £325 per week. The number of levers was reduced by the all-electric system from 645 to 311, and during 1920 the cost of maintenance of the system only amounted to £123 per route-mile.

Birmingham and District Electric Club.—On March 11th a paper on "Ball Bearings, with special reference to Electrical Machinery," was read by Mr. C. Allen, of the Skefko Co. The lecturer gave an excellent account of the physical, mechanical and mathematical considerations which governed the design and construction of ball and roller bearings, with special reference to the investigations of Hertz, Striebeck and Goodman. Single-row and double-row self-aligning bearings were explained, with the thrust capacity of each type. A number of figures were given, bearing upon transmission efficiency of plain and ball bearings, the coefficient of friction of ball bearings being given at .001 and of plain bearings, under good conditions, of at least ten times this figure. An account was given of recent experience and practice on the Continent and in America, where large motors and rotary converters were being constructed with ball bearings with very satisfactory results.

Junior Institution of Engineers.—At a meeting held in the Caxton Hall, S.W.1, on March 17th, an interesting lecture on "Power Factor Improvement" was delivered by Mr. G. H. Ayres. The lecture covered the subject in a very full manner, and was well illustrated by lantern slides. Mr. Ayres first went into the nature of the power factor of an a.c. circuit, showing how a low power factor necessitated additional plant to deal with a given load as well as requiring cables of larger section—a serious item in long-distance transmission. Then the lecturer described in fairly full detail methods of improving low power factor, dealing first with static condensers. Several types made by the British Insulated & Helsby Cables, Ltd., were illustrated. The Scherbius phase advancer and the Miles-Walker correcting apparatus were then described. The oscillator or vibrator designed by Dr. Gisbert Kapp was also dealt with, and various forms of this, made by a number of electrical firms, were shown on the screen. Comparative costs per kVA of the several methods were given. The lecturer also made mention of the ways in which electricity supply authorities encouraged good power factor and penalised low power factor, stating that the most practical method seemed to be to fix a "datum" line for charges, and deduct from or add to this in the same proportion as the consumer's power factor rose above or fell below the selected percentage.

Chelmsford Engineering Society.—On March 9th, Dr. Aitchison, of Birmingham, gave a lecture on "Steel as an Engineering Material." The crystalline structure of steel was fully explained, illustrations being shown of crystals varying in size from minute particles to nearly four inches in length. During forging or rolling of the ingots these crystals are drawn out into fine fibres, and the properties of the metal vary considerably according to the direction of the fibres or grain in the test piece. Sharp corners and notches and small particles of slag in the steel frequently cause local stresses, and sometimes complete fracture of the part. The lecturer was of opinion that the actual composition of a steel was not so important as its condition and constitution with regard to heat treatment.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The recommendations of the Salford Electricity Committee with reference to the resignation of MR. J. A. ROBERTSON, borough electrical engineer, and his appointment as consulting engineer at a retaining fee of £500 per annum, part of his duties to be supervising the construction of the new generating station at Agecroft at a fee of £2 per cent. upon its total cost (see ELEC. REV., March 3rd, 1922, p. 310), came before a special Council meeting last week and the adjourned meeting on Wednesday this week. At last week's meeting there was a lengthy discussion. The Committee revised its original recommendation, substituting a fixed fee of £14,000 for 2 per cent. on the cost, but there was an amendment to refer the matter back on certain grounds, one of the points of controversy being whether Mr. Robertson should be permitted to employ the servants of the Corporation. Last week the amendment was adopted by 31 votes against 17, and the Council accepted a motion to adjourn for a week. When the Council met on Wednesday it transpired that there was misunderstanding in regard to the controversial point mentioned above. As a matter of fact, it had been proposed that from the sum fixed as the fees for the Agecroft station, Mr. Robertson was to bear the whole of the expenditure on technical staff, offices, preparation of specifications, drawings, &c.

Mr. Robertson felt it to be necessary to relinquish the routine work of the Salford department when he was engaged by the Preston Corporation to construct a new power station, but the Salford Committee desired him to retain his connection with the department and act as consulting engineer. It is not surprising, therefore, that on Wednesday the Council reversed last week's decision and referred the question of Mr. Robertson's appointment as consulting engineer to a special meeting of the Council.

It is announced that SIR WILLIAM NOBLE intends to retire from the position of engineer-in-chief to the General Post Office, which he took up in June, 1919. He was knighted in 1920. Sir William is 61 years of age. An account of his career, together with a photograph, appeared in the ELECTRICAL REVIEW for May 9th, 1919.

An Adelaide newspaper stated early in January that it was reported that the chairman of the Municipal Tramways Trust (MR. A. B. MONCRIEFF, C.M.G., C.E., M.I.C.E.) desired to retire from the position, and that he intended to take a trip to England at a later date. Mr. Moncrieff was first appointed in 1910, for a term of six years, and when that expired, in January, 1916, he was selected again for another 12 months, and so on until the present. He is now in his seventy-seventh year.

Tenders states that MR. C. H. WICKHAM, of the Adelaide Tramways, has been appointed works manager to the Melbourne Tramways Board.

MR. W. T. KERR having now left the City of Hereford Electricity Department, asks that for the next few weeks all communications with regard to the West Gloucestershire Power scheme should be addressed to him at "Netherwood," Tupsley, Hereford.

MR. G. J. STANLEY, A.M.I.E.E., has changed his address to 82, Queen's Drive, West Derby, Liverpool.

The Times announces the engagement between TREVOR F. D. ROSE (late R.F.A.), only son of Mr. and Mrs. Rose, of 66, Portland Place, London, W., and IRENE PHYLLIS, younger daughter of Mr. and Mrs. Hugo Hirst, of 40, Park Lane, London, W, and "Foxhill," Earley, Berkshire.

MAJOR H. O. WRAITH, M.I.Mech.E., M.I.E.E., has been appointed manager of the Lighthouse Department of Messrs. Chance Bros. & Co., Ltd., Smethwick, Birmingham.

Obituary.—DR. J. T. MERZ.—We regret to record that Dr. J. T. Merz, Ph.D., Hon. D.C.L., LL.D., Vice-Chairman of the Newcastle-upon-Tyne Electric Supply Co., Ltd., passed away at Newcastle-upon-Tyne on March 21st. Dr. Merz, who was born at Manchester in 1840, at first devoted himself to chemistry, although he was also a mathematician of a high order. But in addition to his other extensive scientific and philosophical work, he was from an early date interested in the development of electrical supply. He was one of the founders of the Newcastle-upon-Tyne Electric Supply Co., established in 1889, of which he was for many years chairman. He was closely connected with, and took the deepest interest in, the expansion of this company from an electric lighting company into one of the most important power undertakings in the country. He was also, in 1881, a director of the Swan Electric Light Co., the first glow-lamp manufacturers in this country. In addition to all his business interests he also took a close interest in the question of technical education, and was for many years closely associated with the work of the Armstrong College, Newcastle. Among his numerous important literary works, the most notable were "A History of European Thought in the Nineteenth Century," "Religion and Science," and "A Fragment on the Human Mind."

Will.—The late MR. J. C. GLEGG, a director of the Aberdeen Electrical Engineering Co. and of various other Scottish undertakings, left £50,840.

NEW COMPANIES REGISTERED.

Lelios Lamp Co., Ltd (180,339).—Private company. Registered March 15th. Capital, £2,500 in £1 shares. To acquire the business of A. de Jong, carried on at St. Andrew's House, 32-4, Holborn Viaduct, E.C.1, and to carry on the business of electricians, electrical engineers, manufacturers of, and dealers in, and agents for all kinds of electric lamps, &c. The subscribers (each with one share) are:—W. J. Woodhouse, 66, Cecile Park, Crouch End, N.8, articled clerk; S. Groves, 32, Preston Road, Brighton, Sussex, law student. A. de Jong, signs as director. Registered office: 32-4, Holborn Viaduct, E.C.

Workington Electric Power Co., Ltd. (180,361).—Private company. Registered March 15th. Capital, £50,000 in £1 shares. To carry on the business of manufacturers and suppliers of electrical energy, &c. The first directors are:—S. Kelly, "Bryanabad," Maxwell Road, Bangor, Co. Down, merchant; Mrs. M. Kelly, no address given; S. Moss, Station Street, Belfast; T. S. Durham, Hensingham Road, Whitehaven, mining engineer. So long as the St. Helens Colliery and Brickworks Co., Ltd., hold £9,000 shares they may appoint one of their directors to be a director of this company. Qualification (except such nominee, who requires none), £100. Remuneration as fixed by the company. Secretary: W. Addison. Solicitor: O. F. Ormrod, Whitehaven, Cumberland.

Dalgetti Electric, Ltd. (180,308).—Private company. Registered March 14th. Capital, £500 in £1 shares. To carry on the business of electrical engineers for dealing in all contracts and sales of electrical fittings and materials pertaining thereto, &c. The first directors are: W. E. L. Bury, 3, Walverton Avenue, Kingston Hill; R. H. Limming, 34, Caversham Road, Kingston; J. G. White, 35, Auckland Terrace, Kingston. Qualification, 50 shares. Registered office: 10, Conduit Street, W.

London Lamps, Ltd. (180,314).—Private company. Registered March 14th. Capital, £500 in £5 shares. To carry on the business of manufacturers of and dealers in electrical and other lamps and apparatus, &c. The subscribers are:—G. C. Walsh, 69, Hatton Garden, E.C., electrical engineer; J. Mackay, 69, Hatton Garden, E.C., company secretary. G. C. Walsh is sole permanent director. Secretary: J. Mackay. Registered office: 69, Hatton Garden, E.C.1.

London Radio College.—The London Radio College, Ltd., has been registered as a "private" company with a nominal capital of £2,000 in £1 shares. The objects are: to establish schools for instruction in radio-telegraphy or telephony or other method of intercommunication, &c. The subscribers (each with one share) are:—A. E. Fournier, 18, Fleet Street, E.C., articled clerk; J. Ball, 18, Fleet Street, E.C., clerk. The directors are to number not less than two nor more than six. The Radio Communication Co., Ltd., shall have the right to be represented on the board by one-half of its members and to nominate one of such number to be chairman. Subject thereto the subscribers are to appoint the first directors. Qualification, £50. Remuneration as fixed by the company. Solicitors: Amery, Parkes & Co., 18, Fleet Street, E.C. No notice of situation of registered office was filed at time of incorporation. The file number is 180,296.

Perfecta Electric, Ltd. (180,298).—Private company. Registered March 13th. Capital, £1,000 in £1 shares. To acquire "The Perfecta Cinema Shutter" from the patentee, J. H. Greenfield, and to carry on the business of kinema, theatrical and general maintenance work, electricians, mechanical engineers, &c. The permanent directors are:—J. T. Hall, 557, Crookesmoor Road, Sheffield; J. H. Greenfield, 91, Pickering Road, Sheffield; A. G. Hides, 46, Owlergreave Road, Darnall, Sheffield. Qualification of first three directors: must be a member of the company; of other directors, £200. Remuneration, £20 each per annum. Solicitor: J. Baker, 29, Bank Street, Sheffield.

Elite Electricars, Ltd. (180,386).—Private company. Registered March 17th. Capital, £2,000 in £1 shares. To carry on business as indicated by the title. The subscribers (each with one share) are:—E. H. Lewis, 9, Plasturton Place, Cardiff, motor engineer; F. S. Munn, 158, Cathedral Road, Cardiff, engineer. F. S. Munn signs as director. Remuneration as fixed by the company. Solicitor: C. Crowther, 23, Abingdon Street, Westminster.

Bideford and District Electric Supply Co., Ltd.—Prospectus of a company to be formed to acquire the benefit of two agreements entered into by S. I. Knill, of Barnstaple, sanctioning the construction of work for the supply of electricity in Bideford and Northam, &c. Capital, £25,000 in £1 shares (7,500 7 per cent. preference and 17,500 ordinary). Proposed directors:—Major W. Ascott, O.B.E., "Westbridge," Bideford; E. W. S. Bartless, "Glenburnie," Bideford; J. U. Fulford, J.P., "Southcote," Bideford; J. N. A. Houblon, M.I.E.E., "Boxford," Newbury; Sir Robert M. Hyslop, J.P., C.C., 139, Cannon Street, E.C.; H. N. G. Stuceley, J.P., "Moreton," Bideford; G. C. Smyth-Richard's, "Filleigh," South Molton. Engineers and contractors: Crompton & Co., Ltd., London and Chelmsford. Solicitors: Hole, Seldon & Ward, Bideford. Secretaries and office (pro tem.): Robert & Richard Blackmore, "Alexandra House," The Quay, Bideford.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

East India Tramways Co., Ltd. (74,457).—Return dated December 8th, 1921. Capital, £100,000 in £1 shares (15,000 preferred, 35,000 ordinary, and 50,000 deferred). 7,476 preferred, 33,433 ordinary, and 50,000 deferred shares taken up. £7,489 paid, including £6 paid on 24 preferred shares forfeited. £83,426 considered as paid. Mortgages and charges, nil.

Brecknell, Munro & Rogers, Ltd. (79,766).—Capital, £150,000 in 2,200 pref. shares of £5 each and 278,000 ordinary shares of 10s. each. Return dated January 25th, 1922. 2,058 pref. and 174,820 ordinary shares taken up. 10s. per share called up on 160,767 ordinary and £5 per share on 2,058 pref. £90,673 10s. paid. £7,031 considered as paid on 14,062 ordinary shares. Mortgages and charges, nil.

Hexham and District Electric Supply Co., Ltd.—Debenture and mortgage both dated February 24th, 1922, to secure £23,000, charged on the company's undertaking and property, present and future, including uncalled capital and certain land and premises at Hexham Bridge End, Northumberland. Holders: D. M. Muir, Grey Street, Newcastle-on-Tyne; and T. H. Oxley, 5, Princes Street, E.C.

Bourne End and District Electricity Corporation, Ltd.—Issue on February 28th, 1922, of £1,102 8s. 10d. debentures, part of a series already registered.

Cesco, Ltd.—Debenture dated March 2nd, 1922, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.

Dubilier Condenser Co., Ltd. (in voluntary liquidation) (formerly Dubilier Electrical Syndicate, Ltd.).—Satisfaction in full on November 7th, 1921, of debenture dated February 17th, 1920, securing £20,000.

Burnham and District Electric Supply Co., Ltd.—Particulars of £750 debentures authorised October 5th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Oldham, Ashton & Hyde Electric Tramways, Ltd.—Satisfaction in full on various dates from July 25th, 1916, to January 1st, 1921, of debentures issued under trust deed dated July 21st, 1899, securing £15,800, filed March 14th, 1922 (liquidators appointed August 3rd, 1921).

National Conduit and Cable Co., Ltd. (59,251).—Return dated December 31st, 1921. Capital, £1,000 in £1 shares. All shares taken up. £7 paid. £993 considered as paid. Mortgages and charges, nil.

Chadburn's (Ship) Telegraph Co., Ltd. (56,572).—Return dated February 14th, 1922. Capital, £120,000 in £1 shares (60,000 pref. and 60,000 ordinary). All shares taken up. £1 per share called up on 50,000 pref. and 50,000 ordinary. £100,000 paid; £20,000 considered as paid on the remainder. Mortgages and charges, nil.

India Rubber, Gutta Percha and Telegraph Works Co., Ltd. (11,220).—Return dated December 14th, 1921. Capital, £1,250,000 in £1 shares (750,000 ordinary, 250,000 pref., and 250,000 unissued). All the ordinary and preference shares taken up and paid for in full. Mortgages and charges, £400,000.

Central Electric Supply Co., Ltd. (53,080).—Return dated February 28th, 1922. Capital, £100,000 in £5 shares. All shares taken up and paid for in full. Mortgages and charges, £1,000,000.

Perfect Burglar Alarm Co., Ltd. (112,522).—Return dated February 9th, 1922. Capital, £4,000 in 1,000 pref. and 3,000 ordinary shares of £1 each. 230 preference and 1,710 ordinary shares taken up. £1,382 10s. paid, being £1 per share on 1,210 and 15s. per share on 230. 500 shares considered as fully paid. Mortgages and charges, nil

Vaughan Crane Co., Ltd. (61,526).—Return dated February 1st, 1922. Capital, £150,000 in 50,000 pref. and 100,000 ordinary shares of £1 each. 16,680 preference and 53,578 ordinary shares taken up. £43,469 paid; £26,789 considered as paid. Mortgages and charges, £5,000.

Railway Finance and Construction Co., Ltd. (72,015).—Return dated January 12th, 1922. Capital, £100,000 in £1 shares. 92,292 shares taken up. £6,576 paid, being £1 per share on 657 and 4s. per share on 29,595. £85,716 considered as paid, being £1 per share on 62,040 and 16s. per share on 29,595. Mortgages and charges, nil.

CITY NOTES.

County of London Electric Supply Co., Ltd.

Sir Harry Renwick, K.B.E., presided at the annual general meeting on March 14th, and in moving the adoption of the report and accounts said that in spite adverse trading conditions the financial position of the company had been strengthened. While the revenue had increased by over 10 per cent., expenditure had decreased by about 6 per cent. These results were due to economies effected through improvements made in generation and distribution, and much credit was due to the engineering staff. Rates and taxes had shown a rise of £18,000, making the rate of taxation .37d. per unit sold, almost three times the pre-war figure. At this point the chairman registered a protest against extravagant municipal expenditure, stating that it was time an "axe" was applied to it. It was only fair to say, however, that many authorities were seriously trying to reduce expenditure. He drew attention to the substantial increase in reserves which had been made during the year. The capital expenditure had reached the figure of £2,929,751, a net increase of £195,749 for the year. Turning to the working of the company, Sir Harry Renwick said that the units sold during the period under review had risen by 1,666,856 to 51,220,079. An addition of 6,098 kW had been made to the company's connections. These increases, although not up to previous rates of increase, were satisfactory. Early in 1920 the company applied to the Electricity Commissioners for permission to erect a large station at Barking. Although an inquiry had been held in October of that year, the scheme was held up pending a further inquiry. At last, however, permission had been secured, a special Act had been obtained and the station was destined to play a large part in the future supply of electricity to London. Referring to the last Electricity (Supply) Bill, the chairman said that there was much useful matter in it, but several clauses required drastic amendment, especially that permitting the creation of separate stations by railway companies. In conclusion, he forecasted another successful year and increasing success.

The Swedish Volta Co.

The *Svensk Handelstidning* states that the Elektriska A.B. Volta has resolved to go into liquidation. The negotiations which have been proceeding for some time past to procure further capital have proved unsuccessful. In 1920 the company was reconstructed by the share capital being reduced from 5,000,000 kr. to 2,500,000 kr.; and preference shares for 3,000,000 kr. and new ordinary shares for 1,000,000 kr. were subscribed. The year 1920 resulted in a loss of 2,300,000 kr. The newspaper states that the cause of the company's difficult position should be sought in the great expansion which took place in the favourable years of 1918 and 1919. The large workshop installations, which then were brought into existence, must have caused great losses in association with the considerable stocks.

A Swiss Investment Company.

The report of the Schweiz. Gesellschaft fur Electrische Industrie, of Glarus, states that the 4½ and 5 per cent. loan had been exchanged for 6 per cent. cumulative preference shares, and the share capital reduced from 20,000,000 to 4,000,000 francs. Owing to exchange conditions it was impossible to pay any dividend on the preference capital for 1921. The exchange deficiency rose from 27.88 millions of francs in 1920 to 29.90 millions last year. The year yielded a gross surplus of 650,000 fr., but as the legal redemption instalment of the exchange deficiency absorbed 1,660,000 fr., the past year closed with a loss of 1,010,000 fr. This compares with a loss of 22.33 millions of francs in 1920, before the reconstruction of the company.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The connections to the company's system during 1921 increased by 23,596 h.p. to 365,536 h.p. The profit was £347,219, against £392,643 for 1920. There is carried to reserve for plant renewals and improvements £10,000, as against £30,000 in 1920, leaving £337,219, plus £13,091 brought forward, making £350,310 available, against £372,241. From this £106,442 is required for debenture and loan interest (against £57,914); and £50,000 is put to reserve for special depreciation and contingencies other than equalisation of dividends (against £25,000). The dividends on the 7 per cent. and 5 per cent. preference shares require £179,885, but there is no dividend on the ordinary shares (this required, at 8 per cent., £103,814 in the previous year), and £13,982 is to be carried forward. The expenditure on plant renewals and improvements during the year amounted to £9,441. "The three months' stoppage of the coal mines and the general depression in trade caused a serious reduction in the company's output, and this, together with a continuance of high labour costs, has materially affected its profits. As a result the directors are unable to recommend the payment of a dividend on the ordinary shares. The additional capital expenditure on works for the year amounted to £801,862, and represents power station extensions, and additions to the company's transmission and distribution system. This amount, together with £581,364, representing discount on, and expenses of, issue of debenture stocks, makes a total charge to capital account of £1,383,227. During the year £1,383,109 of first and £850,000 of second mortgage debenture stocks were issued; of this last-mentioned sum £750,000 was issued in December last. Prior to that issue a meeting of the second mortgage debenture stockholders was held, at which the authorised amount of the stock was increased from £500,000 to £2,000,000, and the rate of interest payable from 5 to 6 per cent. per annum. The Whitehall Trust, Ltd., has been duly appointed to act as sole trustee for the first mortgage debenture holders.

tish Insulated and Helsby Cables, Ltd.

The profit for 1921, after making provision for estimated liability for Corporation Profits Tax to date, amounts to £502,524, plus £116,864 brought forward; directors' and debenture trustees' fees, and remuneration to works' committee amount to £9,665; interest on first debenture stock, £22,500; interest on second debenture stock, £10,000; dividend on preference shares, £30,000; interim dividend on ordinary shares to June 30th, 1921, £37,500. These leave a disposable balance of £509,723, out of which there has been appropriated to depreciation on buildings, plant, machinery, &c., £30,000; and transferred to first mortgage debenture stock redemption account £5,000. The directors recommend a further dividend of 6% per cent. on the ordinary shares, together with a bonus of 5 per cent., making, with the interim dividend, a total of 15 per cent. for the year, absorbing £112,500; and leaving to carry forward £362,223. Though fully employed during the first half of the year, the factories were not so busy during the latter half, and there has recently been a decided diminution in the value of the orders received. Meeting, March 27th, at Liverpool.

Brompton & Kensington Electricity Supply Co., Ltd.

The annual general meeting was held on March 16th, Mr. H. R. Beeton presiding. In moving the adoption of the report and accounts, the chairman expressed satisfaction at the results, stating that, in spite of difficulties, the year under review had been one of progress. Although the total works costs had doubled during the war, the company's prices had only risen by 33 per cent. A new 1,500-kW turbo-alternator had been installed during the year, but, owing to delays in delivery, the benefits from it were only obtained during the last month of the year. This addition to the plant would be sufficient to meet the demand for some time to come. Its cost (£39,000) would be provided entirely out of profits. Owing to the coal strike and other adverse circumstances the company's net profit was slightly reduced. The dividend, however, was main-

tained at the previous year's level, and a larger sum was being carried forward.

Referring to the Accessories Co., the chairman said that its assets were still worth their book value; it constituted one of their best customers; and contributed effectively to the supply business.

Browett, Lindley and Co., Ltd.

After deducting £2,929 for debenture and bank interest, writing off £6,244 for depreciation, and making provision for taxation and contingencies, there is a net profit for 1921 of £14,058, plus £9,178 brought forward. After paying 6 per cent. per annum (less tax) for the year on the preference shares, and a further dividend of 11¼ per cent., less tax, on preference shares, disposing of all arrears, a dividend of 10 per cent., less tax, is paid on the ordinary shares, leaving £10,737 to carry forward. A night shift has been worked for the greater part of the year, and the output constitutes a record in the company's history, excluding the war period. The orders on hand are considerably less than they were a year ago, and the night shift has been stopped, but the new year has shown an improvement in the orders received. The 5 per cent. first mortgage debenture stock, which fell due for redemption on January 1st, 1922, was renewed for a period of ten years at the rate of 7½ per cent. per annum. Of the £50,000 authorised, only £20,000 has been issued to the public, and it is not intended to place any more at present.

Urban Electric Supply Co., Ltd.

The balance carried to net profit and loss account for 1921 is £95,563, as compared with £86,685 a year ago. After deducting debenture charges and income tax, amounting to £60,856, and adding £2,163 brought forward, the available balance of £36,869 is to be dealt with as follows: to reserve for depreciation, £25,000; one half-year's dividend on the cumulative preference shares, £6,250; carrying forward £5,619.

The following table shows the load connected in kW and the income from the undertakings in 1920 and 1921:—

	Load in kw.		Profits.	
	1920.	1921.	1920.	1921.
Hawick	4,145	4,340	£10,758	£5,787
Stamford	1,934	1,726	1,958	3,393
Weybridge and Walton ..	4,470	4,4?3	5,601	9,160
Godalming	2,192	2,253	3,514	3,8 8
Twickenham and District ..	12,077	13,141	22,3?9	29,291
Dartmouth	1,189	1,230	1,587	2,443
Camborne, Redruth & Cornwall..	9,562	9,756	4,735	6,336
Newton Abbot	2,097	2,1?9	2,840	5,382
Grantham	2,439	2,520	7,069	7,679
Glossop	1,709	1,856	6,425	5,820
Berwick	1,386	1,654	2,449	3,291
Caterham	1,380	1,447	1,950	2,5?2
Newbury	1,593	1,665	5,4?0	5,583
Cornwall Co.	—	—	7,200	—
Penzance Co.	—	—	621	751
Totals	46,882	48,120	—	—

Chelsea Electricity Supply Co., Ltd.

The annual meeting was held on March 15th. Mr. W. R. Davies (chairman), who presided, said that the accounts were even more satisfactory than those of last year, when he congratulated the shareholders upon the results. The directors were able, for the first time in 16 years, to present an absolutely clean balance sheet. It had taken this period to extinguish the founders' shares for which a special Act was obtained in 1905, but their extinction was now accomplished, and the net profits would, in future, be wholly devoted to payment of dividends. The amount of debenture stock outstanding had been reduced to £89,670, and the depreciation fund, notwithstanding heavy withdrawals for the purchase of replacement plant, now stood at £205,000. So that if the company was bought out in 1931, the date of expiry of the present Provisional Order, the shareholders would receive at least the par value of their holdings. Mr. Davies hoped that future dividends would be larger, and also that charges would be lower. The bulk supply agreement with the Central Electric Supply Co. would eventually furnish all the power required in excess of that provided by the company's Diesel plant, which it was intended to keep in commission. The capital commitments in respect of this bulk supply would ultimately amount to between £35,000 and £40,000, but there were sufficient funds in hand for this purpose. Investments, valued in the balance sheet as £45,022, had a present-day value of £51,000; a certain amount of these would be sold to provide funds for taking the bulk supply.

City of London Electric Lighting Co., Ltd.

Mr. J. B. Braithwaite (chairman) presided at the annual meeting, held on March 15th. He said that in spite of considerable difficulties the revenue had increased, and expenses had not increased in the same proportion. Referring to the Electricity (Supply) Act, of 1919, which he thought had been greatly over-rated, he said that the net result of the Electricity Commissioners' three years' work was the delimitation of the boundary of the London district, but no scheme for co-ordinating the supply had been approved.

The company's Bankside station was destined to play an increasingly important part in the supply of electricity to London, and the company had been doing all it could to help forward the solution of the problem. The Electricity (Supply) Bill, now before the House of Lords, contained, in its present shape, a number of clauses, which, the company thought, required considerable modification to render the measure effective. Companies were severely handicapped, as compared with local authorities, by the fact that their tenure was limited. An extension of tenure was essential, and the Commissioners had stated that they approved of this extension "in principle" for the London companies.

Turning to the working of the company, Mr. Braithwaite said that considerable economies had been effected, and it was hoped that charges would be reduced during the current year. An extended tenure would greatly facilitate the return to pre-war prices. The new plant had been installed and would be running in a week or two. The capital raised during last year would be sufficient for the present; the chairman hoped that the next amount would be raised on more reasonable terms.

Newcastle and District Electric Lighting Co., Ltd.

The net profit for 1921, after charging debenture and loan interest, and allowing £14,000 for depreciation, is £8,101, plus £13,955 brought forward. After paying 4 per cent. less income tax, £13,725 is carried forward. The coal dispute and trade depression had an adverse effect on the demand for energy. £1,320 of 6 per cent., second mortgage debentures has been redeemed and loans of £3,963 repaid. Capital expended during the year £29,895, largely on mains for new consumers. Dr. J. B. Simpson has resigned from the board owing to ill-health. He had been a director since the formation of the company, and chairman for the last 15 years. His son, Lt.-Col. F. R. Simpson, has been appointed chairman.

Direct Spanish Telegraph Co., Ltd.—The report for 1921 shows that, after including £25,173 brought forward, and after paying income tax, loan interest, E.P.D. and Corporation Profits Tax, the balance is £17,644. The preference and ordinary dividends of 10 per cent. require £9,465; £5,000 is put to reserve; and £3,179 is carried forward, subject to Corporation Profits Tax. The cables worked well during the year.

Electro-Bleach and By-Products, Ltd.—At the annual meeting, on March 15th, the chairman, Mr. A. T. Smith, said that having regard to the troublous times they had passed through it was satisfactory to have been able to pay their preference dividend. They had been able to slightly reduce wages during the year, but he feared that the present labour troubles would have the effect of increasing prices again.

British Thomson-Houston Co., Ltd.—Issue of £1,500,000 7 per cent. debenture stock. It is announced that allotment letters and scrip certificates should be forwarded to the company's office, Crown House, Aldwych, W.C.2, for exchange for definitive certificates.

Carmarthen Electric Supply, Ltd.—The accounts for 1921 show a profit of £886, plus £644 brought forward. The directors recommend that £545 be transferred to the depreciation fund, and after paying the preference dividend the ordinary shares are to receive 5 per cent. (less income tax), leaving £497 to be carried forward.

Pritchett & Gold and E.P.S. Co., Ltd.—The financial Press reports a dividend of 10 per cent., less tax, on the ordinary shares. £10,000 is put to reserve, and £29,063 is being carried forward, subject to income and Corporation taxes.

Isle of Wight Electric Light and Power Co., Ltd.—The directors, according to the *Financier*, are paying 10 per cent. on the preference shares for the two years ended April, 1920, putting £10,000 to renewal fund, and carrying forward £583.

British Aluminium Co., Ltd.—Final dividend at the rate of 5 per cent. per annum on the ordinary shares, making 5 per cent. for the year. £20,000 to depreciation reserve; £10,000 to reserve; £14,791 carried forward.

County of Durham Electrical Power Distribution Co.—Profit for 1921, £60,952, plus £1,274 brought in. Dividend of 11¼ per cent. for year on ordinary shares, carrying forward £842.—*Financial Times.*

Robey & Co., Ltd.—Dividend of 2½ per cent., less tax, on preference and ordinary shares; £1,000 to provident fund for employés; carrying forward £26,517.

Llanelly and District Electric Lighting and Traction Co., Ltd.—Dividend on the ordinary shares for 1921, 7 per cent., less tax; carried forward £472.

Madras Electric Tramways (1904), Ltd.—A final dividend at the rate of 6 per cent. per annum, less tax, is to be paid on the preference shares.

Liverpool District Lighting Co., Ltd.—The directors announce a dividend of 5 per cent., less tax, for 1921.

Metropolitan-Vickers Electrical Co., Ltd.—The directors recommend a dividend on the ordinary shares of 12½ per cent., less income tax, for the year 1921.

Ransomes, Sims & Jefferies, Ltd.—According to the *Financier* no preference dividend is to be paid.

Prospectuses.—*The Navsari Electric Supply Co., Ltd.*—We have received a copy of the prospectus of this company, which was issued in India a short time ago, inviting subscriptions to a first issue of 40,000 ordinary shares of Rs. 10 each at par, 2,000 of which were taken up by the vendor (Mr. A. K. Modi, the proprietor of the Pioneer Electric Co., of Bombay), the remainder being offered publicly. The company was to purchase Mr. Modi's business, named above, and the Navsari electric licence 1921 granted to him by the Government of Baroda for electricity supply for all purposes, except in bulk. A power station is to be put down and distribution will be a.c. with overhead mains. The Tata Engineering Co., Ltd., has prepared a scheme under which the buildings, plant, and four miles of street lighting and overhead mains, will cost Rs. 3,50,000.

Jutland Telephone Co., Ltd.—This week an issue of £500,000 in 5½ per cent. sterling bonds of £100 each has been advertised in the London Press at £93 per bond. The capital and interest are unconditionally guaranteed by the Danish Government. The proceeds will be employed for the extension of the company's system.

The list was closed early on Monday morning, the issue having been well over-subscribed.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The ordinary general meeting was held on March 16th. Col. R. E. Crompton, C.B., chairman of the company, who presided, said he was glad to tell them that the wave of bad trade had not affected the company as it was feared at one time it would do. When they considered the high cost of coal and material and the heavy taxation, local and otherwise, they had every reason to congratulate themselves upon the satisfactory balance-sheet which was placed before them. He hoped that this good progress would continue, so that they might be able to supply energy to customers at a decreased rate.—*Financial News.*

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a :—

Cordoba Light, Power & Traction Co.—75,571 ordinary shares of £1 each, fully paid, Nos. 600,001 to 675,571.

Cordoba Light, Power & Traction Co.—300,000 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 300,000; 365,811 new 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 300,001 to 665,811.

Marconi's Wireless Telegraph Co.—20,000 ordinary shares of £1 each, fully paid, Nos. 2,913,259 to 2,933,258.

The undermentioned have been ordered to be officially quoted :—

Cordoba Light, Power and Traction Co.—75,571 ordinary shares of £1 each, fully paid (Nos. 600,001 to 675,571).

Marconi's Wireless Telegraph Co.—20,000 ordinary shares of £1 each, fully paid (Nos. 2,913,259 to 2,933,258).

Midland Electric Corporation for Power Distribution.—The *Financial Times* reports that the net profit for 1921 was £105,858, plus £18,517 brought in, making £124,375. After deducting interest on debenture stock and loan, depreciation on plant, machinery, &c., amount written off commission and expenses of issues of debentures and shares and expenses during construction, transfer to debenture stock redemption account £500, to reserve £5,000, preference dividend and interim ordinary dividend, there remained £47,404. The directors recommended a further dividend on the ordinary shares of 6 per cent., making 10 per cent. for the year, carrying forward £30,604.

German Companies.—The *Badische Landeselektrizitätsversorgung Gesellschaft*, of Carlsruhe, has just invited applications for 5 per cent. debentures to the extent of 300,000,000 marks, issued at 100½ per cent. Applications are also being invited by the *Oberbauerische Ueberlandzentrale Gesellschaft*, of Munich, for 6,000 new shares of 1,000 marks each, issued at a premium of 180 per cent.

Hadfields, Ltd.—Final dividend of 6d. per share, making 5 per cent., free of tax, for the year.

Bell Telephone Co., of Canada.—The net earnings for 1921 were $2,276,421, after providing $2,549,715 for depreciation and $595,000 for taxes. Interest charges absorbed $1,168,800, and after providing for dividend of 8 per cent., a deficiency remains of $776,009. Surplus and reserves stand at $22,501,399.—*Financier.*

STOCKS AND SHARES.

Tuesday Evening.

The City talks of cheaper money after the present comparative "tightness" is over, but it is doubtful whether any real hope of a reduction in the Bank Rate is entertained as likely to materialise on this side of Easter. The first quarter of the year is, of course, the most productive from the point of view of the Treasury, because taxes pour in at an especially rapid rate during the last few weeks of the nation's financial year. The Government has plenty of money in hand, so there is no particular call for national borrowing. In spite of an occasional spasm of stiffer rates, the present position tends to make for ease in the money market, and, therefore, increases the possibility of another fall in the Bank Rate. Stock Exchange markets reflect the considerable amounts of capital available for investment, and prices are well maintained in most instances. The volume of business, however, is smaller than that of two or three weeks back, and the unrest in domestic labour circles, in South Africa, India, Kenya, Egypt, and elsewhere is imposing something of a check upon the willingness of the public to invest their money in Stock Exchange securities.

All the electricity companies have now presented their accounts. In some cases, the meetings have been held, and the County of London function produced an interesting speech from Sir Harry Renwick, the chairman, who took a broad view of the outlook for his company and for London electricity as well. He confessed himself an optimist, and gave chapter and verse for his expectations that the future holds every promise of hopefulness for extension of the use of electricity in bulk. Shareholders in other electrical companies cannot fail to derive satisfaction from the prospects which open up for the industry, and not even Parliament is likely to be able to retard the progress which the current year should witness.

The Brompton & Kensington company made a profit last year of £41,000, or about £1,900 less than that for 1920, while the profit of the Charing Cross & West End, namely, £100,400, showed a reduction of about £2,400, though the City undertaking wiped this out with a profit of £111,300, an increase of about £48,000. The City of London's £231,300 profit was £20,000 up, and the County of London, with £342,000, showed a gain of £98,000. Chelsea's £43,400 is £1,500 better, and the Metropolitan company announce a profit of £114,200, being some £7,000 up. St. James's made £10,000 more than in the previous year, and the South Metropolitan topped £100,000—some £17,500 higher than the profit in 1920. The Westminster figures showed little variation from those of the previous year. The current number of the *Economist* gives an exhaustive table of the gross annual earnings of the principal London companies for the past seven years, adding the figures of 1913 for purposes of comparison. They are as follows :—

Gross Revenue.

—	1913.	1915.	1916.	1917.	1918.	1919.	1920.	1921.
	£	£	£	£	£	£	£	£
Brompton & Kensington	58,482	76,469	5[illegible],878	61,898	58,795	74,015	103,87[illegible]	110,130
Charing Cross, W. End	151,940	188,9[illegible]	150,473	165,136	193,8[illegible]	205,[illegible]58	211,048	312,533
Do. City	149,815	158,357	176,46[illegible]	212,5[illegible]	238,07[illegible]	231,323	218,746	439,772
Chelsea	72,602	71,480	76,31[illegible]	86 60	86,698	92,629	15, 0	120,416
City of London	311,822	309,000	30.752	347,979	89,85[illegible]	321,116	49,891	576,456
County of London ..	255,67[illegible]	268,269	318,066	379,8[illegible]	451,811	576,116	598,62[illegible]	769 634
Kensington & Knightsbridge	81,85[illegible]	71,478	68,055	78,711	78,908	95,871	127,141	138 105
London	162,85[illegible]	213,96	222,40[illegible]	22[illegible],03	245,589	305,109	272,220	393,674
Metropolitan	3 7,60[illegible]	220 201	27[illegible],909	418,216	348 72[illegible]	[illegible]13,059	516,[illegible]94	86,471
St. James and Pall Mall	146,161	120 [illegible]44	43,072	161,15[illegible]	[illegible]60,96[illegible]	[illegible]08,467	97,959	264,[illegible]97
South Metropolitan .	65,635	80,[illegible]76	95,88[illegible]	[illegible]31 930	[illegible]67 23[illegible]	166,9[illegible]	[illegible]99 0 7	216,8[illegible]9
Westminster .. .	256,600	247,060	2[illegible]2,62[illegible]	306,18[illegible]	286,71[illegible]	362,88[illegible]	04,010	197,093

To complete the comparison it is necessary, of course, to have a statement of expenses. These are the statistics :—

Expenses, including Repairs and Maintenance.

—	1913.	1915.	1916.	1917.	1918.	1919.	1920.	1921.
	£	£	£	£	£	£	£	£
Brompton & Kensington	24,981	30,074	31,940	31,580	40,272	44,684	59,469	69,089
Charing Cross, W. End	6[illegible],866	70,668	76,831	03,268	109,267	167,242	208,21[illegible]	319,116
Do. City	80,68[illegible]	94,590	110,909	147,1[illegible]3	147,158	273,731	355,06[illegible]	978,493
Chelsea	35,052	36,888	44,635	51,01[illegible]	56 68[illegible]	59 59[illegible]	73 530	76,579
City of London	39,721	61,06	199,111	[illegible]09 62[illegible]	2 8,25	41,124	43[illegible],182	145,142
County of London ..	120,53[illegible]	150,393	186,17[illegible]	226,34[illegible]	272,381	3[illegible],643	45 ,37[illegible]	427,432
Kensington & Knightsbridge	47,679	41,891	43,69[illegible]	50,19[illegible]	53,92[illegible]	73,17[illegible]	97,167	104,099
London	91,10[illegible]	186,27[illegible]	167,19	163,2[illegible]	167,56	[illegible]09,8[illegible]	[illegible]72,7[illegible]	[illegible]91, 88
Metropolitan	111,[illegible]17	[illegible]37, 50	161[illegible],009	[illegible]84,543	[illegible]8,112	24 ,6 3	[illegible]318,6[illegible]	329,091
St. James' and Pall Mall	94,016	9[illegible],702	[illegible]15,07[illegible]	123,306	[illegible]30, 3	[illegible]70,4[illegible]	[illegible]87,01	[illegible]20 ,951
South Metropolitan ..	24,065	31,886	45,3 3[illegible]	[illegible]6,567	[illegible]0 ,84[illegible]	96,867	116,21[illegible]	16,193
Westminster	[illegible]54,254	[illegible]6,694	[illegible]67,05[illegible]	188,08[illegible]	[illegible]04,259	[illegible]2 6,188	[illegible]5,7 [illegible]	[illegible]48,8[illegible]9

Substantial improvements in price are shown on the week by Charing Cross ordinary, County ordinary, Kensingtons, and Westminster ordinary, all of these being ex dividend, while gains of half-a-crown have occurred in the cases of Londons, St. James's and several others. Amongst the provincial shares, Bournemouth & Poole rose to 7¼. North Metropolitan 7½ per cent. debentures at 107 are 2 points higher. Edmundson's ordinary stand at half a guinea; the 6 per cent. cumulative preference are in demand at about £3, and the 6 per cent. non-cumulative at 35s. or more. Urbans are 10s., and the preference rather nominal at 30s.

English Electric debenture improved to 88, and the preference shares at 16s. 3d. are half-a-crown higher. General Electrics recovered to a guinea. Metropolitan-Vickers enjoyed a sharp rise, on the announcement of a dividend making 12½ per cent. for the year against 8 per cent. a year ago. The preference at 2 1/16 are another 1/16 up, and the ordinary shares advanced to 22s. Electric Constructions at £1 are 1s. 3d. better; British Insulated ordinary rose to 37s., on the dividend of 6¼ per cent., with the usual 5 per cent. bonus, making 15 per cent. for the year. The profit for last year shows a remarkable

increase. India-Rubber shares at 13s. 9d. are 1/16 lower. The Cable manufacturing group remains hard, with Henleys at 38s. ex dividend. Callenders 4½ per cent. debenture rose 3 to 76½. Telegraph Constructions at 24½ are ex dividend.

Marconis have come to the front again, with a rise to 40s., at which price there are buyers. Marconi Marines stiffened to 26s. 3d., and the market as a whole gives evidence of more vitality than has characterised it recently. Cable stocks are mostly steady. Western Telegraphs at 18⅝ are ¼ lower, and Globes eased off to 18¼, while Anglo-American Telegraph preferred and deferred are both a little down. The reactions, however, in comparison with the previous advances, are trifling. The newly issued stocks and shares and debentures hold their prices with noticeable firmness.

British Electric Traction ordinary is changing hands on the basis of 43, and the preference about 72. The 5 per cent. debenture stock is 76. Metropolitans at 37½ xd. are 2 points up. Underground Incomes, after a rise to 73, reverted to 71½. There is not much doing in Districts. A small amount of the company's 4 per cent. guaranteed stock is offered at 66½, showing a return of 6 per cent. on the money. It is not often that any of this stock comes to market. Anglo-Argentine Tramways are quiet, and Brazil Tractions lost a point. Mexicans remain stagnant. City of Buenos Ayres ordinary at 4 are 5s. higher. Shanghai Electric Constructions—a very narrow market—gained 10s. at 18.

The rubber market holds up fairly well, but there is no trade worth mentioning in the shares. Engineering and armament prices are scarcely affected by the lock-out and its developments. Babcock & Wilcox keep good at 2⅞, and certain of the armament shares are slightly better than they were a week ago.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Mar. 31, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7½	—	£8 5 6
Charing Cross Ordinary	8	9	6xd	+ ⅛	7 10 0
do. do. 4½ Pref.	4½	4½	92	—	6 18 4
Chelsea	6	6	4½	+ ¼	6 13 4
City of London	14	14	84/-	+2/3	7 15 7
do do. 6 per cent. Pref.	6	6	1	—	6 0 0
County of London	8	8	11½xd	+ ⅛	7 2 3
do. do. 5 per cent. Pref.	6	6	94xd	—	6 11 6
Kensington Ordinary	9	10	6	+ ½	8 6 8
London Electric	2½	4	1⅜	+ ⅛	9 5 4
do. do. 6 per cent. Pref.	6	6	4½	+ ⅛	7 5 5
Metropolitan	7	7	4½xd	—	7 15 7
do. 4½ per cent. Pref.	4½	4½	84	—	6 8 7
St. James' and Pall Mall	12	12	7½xd	+ ⅛	8 5 6
South London	7	7	8½	+ ½	8 13 4
South Metropolitan Pref.	7	7	1⅜	—	6 4 5
Westminster Ordinary	10	10	6⅝xd	+4/-	7 11 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	96	—1	6 5 0
do. Def.	1½	1½	21½	— ⅛	8 2 6
Chile Telephone	6	6	53	—	5 11 7
Cuba Sub. Ord.	7	7	7½	+ ⅛	9 0 8
Eastern Extension	10	10	19½	—	5 8 1
Eastern Tel. Ord.	10	10	187½	—	5 6 8
Globe Tel. and T. Ord.	10	10	18¼	— ¼	5 8 1
do. do. Pref.	6	6	10⅞	— ⅛	5 11 7
Great Northern Tel.	22	24	283	—	8 8 3
Indo-European	10	10	98	—	7 2 10
Marconi	25	15	2	+ ⅛	7 10 6
Oriental Telephone Ord.	12	12	9	—	*6 0 0
United R. Plate Tel.	8	8	6⅞	—	*5 16 5
West India and Panama	Nil	Nil	5	—	Nil
Western Telegraph	10	10	18⅝	— ¼	*5 7 5
Home Rails.					
Central London Ord. Assented	4	4	62	—	6 9 1
Metropolitan	1½	1½	87½	+2	6 0 0
do. District	Nil	Nil	27xd	+ ½	3 14 1
Underground Electric Ordinary	Nil	Nil	2	—	Nil
do. do. "A"	Nil	Nil	5/6	—	Nil
do. do. Income	4	2	71½	—	*5 12 0
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	8½	—	8 9 0
do. 2nd Pref.	Nil	5½	9⅝	+ ⅛	7 17 2
do. do. 5 per cent. Deb.	5	5	74	—	6 13 4
Brazil Tractions	Nil	Nil	39	—1	Nil
British Columbia Elec. Ry. Pfce.	5	5	64½	—	7 16 6
do. do. Preferred	5	93/-	58½	—2	*7 18 0
do. do. Deferred	3	12d/-	38¾	—2	*10 13 0
do. do. Deb	4½	4½	6 4xd	—	6 7 9
Mexico Trams. 5 per cent. Bonds	Nil	Nil	58½	—	—
do do. 6 per cent. Bonds	Nil	Nil	37½	—1	Nil
Mexican Light Common	Nil	Nil	16⅝	—	Nil
do. Pref.	Nil	Nil	30½	—	Nil
do. 1st Bonds	Nil	5	63½	—	8 0 0
Manufacturing Companies					
Babcock & Wilcox	15	16	2⅞	—	5 11 4
British Aluminium Ord.	10	10	15/-	—	—
British Insulated Ord.	15	15	87/-	+9d.	8 2 2
Callenders	15	15	12	—	8 11 6
,, 6½ Pref.	6½	6½	1⅛	—	6 7 4
Crompton Ord.	10	10	15/-	—	13 6 8
Edison-Swan	10	—	4/-	—	—
do. do. 5 per cent. Deb.	5	5	62	—	8 1 4
Electric Construction	10	10	1	+ ⅛	10 0 0
English Electric	8	8	9/6	—	16 17 6
do. Pref.	6	6	16/6	+ ⅛	7 7 8
Gen. Elec. Pref.	6½	6½	20/9	—	6 5 4
do. Ord.	10	10	21/-	+9d.	9 10 8
Henley	15	15	38/-xd	—	7 18 0
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	—	1½	— ⅛	—
Met.-Vickers Pref.	8	8	2⅛	+ ⅛	7 15 2
Siemens Ord.	10	12	95/-	—	*8 0 0
Telegraph Con.	20	20	24½xd	— ½	*4 19 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances

Wednesday, March 22nd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	8½d.	½d. inc.
a Ammoniac Sal per ton	£65	..
a Ammonia, Muriate (large crystal) „	£58	..
a Bisulphide of Carbon „	..	..
c Borax „	£83	£2 inc.
a Copper Sulphate „	£27	£2 dec.
a Potash, Chlorate per lb.	5d. to 5½d.	..
a „ Perchlorate „	7½d.	..
a Shellac per cwt	£18 10s.	20/- inc.
a Sulphur, Sublimed Flowers „	£13	10/- inc.
a „ Lump „	£12	10/- inc.
a Soda, Chlorate per lb.	3½d.	..
a „ Crystals per ton	£7	..
a Sodium Bichromate, casks per lb.	5½d.	..
METALS, &c.		
b Aluminium, Ingots per ton	£120	..
b „ Wire per lb.	1/9 to 2/6	..
b „ Sheet „	1/6 to 2/-	..
Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£147	..
Grade II „ „	£106	..
Grade III „ „	£64	..
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	..
c „ Tubes (solid drawn) „	11½d. to 1/-	..
c „ Wire, basis „	10½d.	..
c Copper Tubes (solid drawn) „	1/1½	..
c „ Bars (best selected) per ton	£90	..
c „ Sheet „	£90	..
c „ Rod „	£90	..
d „ (Electrolytic) Bars „	£67 10s.	10/- to 20/- inc.
d „ „ Sheets „	£74 10s.	
d „ „ Wire Rods „	£77 10s.	10/- to 20/- inc.
d „ „ H.C. Wire per lb.	10d to 10⅛d.	..
f Ebonite Rod „	a/b	..
f „ Sheet „	a/-	..
n German Silver Wire „	2/6	..
h Gutta-percha, fine „	12/6	..
h India-rubber, Para fine „	11d.	..
f Iron Pig (Cleveland Warrants) per ton	Nom.	..
f „ Wire, galv. No. 8, P.O. qual. „	£27	..
g Lead, English Pig „	£22 15s.	10/- inc.
g Mercury „	£10 10/- to £11	..
e Mica (in original cases) small per lb.	3d. to 3/-	..
e „ „ „ medium „	4/- to 8/-	..
e „ „ „ large „	10/- to 20/- & up	..
p Phosphor Bronze, plain castings „	1/1	..
p „ „ drawn bars and rods „	1/3½	..
p „ „ rolled strip & sheet „	1/3½	..
p „ „ Wire „	1/3½	½d. inc.
o Platinum per oz.	£19 10/-	10/- dec.
d Silicium Bronze Wire per lb.	1/2	..
r Steel, Magnet, in bars „	1/-	..
n Tin, Block (English) per ton	£143 10s. £143 15s.	1/- to 15/- inc.
n „ Wire, Nos. 1 to 15 per lb.	3/-	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
j Boiling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

A High-voltage Single Transformer.—Another achievement has been added to the list of engineering feats of the Westinghouse Electric & Manufacturing Co., U.S.A., by the construction of the highest-voltage single transformer ever built.

The 1,000-kVA transformer is capable of delivering 1,000,000 volts above earth potential and was built for the company's experimental labatory at Trafford City, Pa. It is believed to be the only single transformer of such high voltage in operation, and it has some novel winding features. It is of the core form construction and the windings contain nearly 70 miles of wire assembled on the principle of a condenser bushing. It is divided into many cylindrical coils, each consisting of one layer of copper, or turns, wound on a micarta tube. As the coils increase in diameter they shorten in length, precisely as does a condenser bushing, except that the tapering of the winding is the same at both ends. The turns of copper in the transformer take the place of the tinfoil in the condenser bushing. The two sets of windings, one on each leg of the core, are cross-connected so as to produce a progressively increasing voltage from the inner, or smallest diameter, coils to the larger diameter coils. The windings of the large-diameter, or line, coils consist of treated cloth-covered cable, so as to withstand surges that are produced when the apparatus being tested flashes over. A condenser bushing is used for bringing the line lead out through the cover of the tank. The transformer is built on the principle of distributing electrostatic stress as developed by Mr. C. L. Fortescue. Special machines had to be fitted to turn the terminal bushing; its length is 19 ft., it is 41½ in. in diameter, and weighs about 9,000 lb. The static shield is 10 ft. in diameter and 20 in. deep.

THE PRESENT SITUATION OF THE POWER STATION ENGINEER.

By E. SMYTHE.

During the present heavy and long-lasting trade depression, the power station engineer has, for the first time in the history of public power supply, suffered unemployment due to the trade slump. It is the contention of the writer that this is not simply an unpleasant and novel experience, attached only to this exceptionally severe depression, but that it will become a recurring feature in the career of the station engineer.

This idea does not seem to be shared by many station men; but to the writer it seems so inevitable and serious as to be worth discussion in the columns of that staunch friend of the station engineer, The Electrical Review.

Anxious paterfamiliases and station men themselves have for 30 years looked on the electrical power station as a place free from the troubles due to bad trade and from the risk of interrupted employment. It is no exaggeration to state that on this account alone, very many quite competent engineers endured salaries and conditions which were for many years a scandal.

To-day, however, the situation has altered, and very much for the worse; for men of long service, holding important official positions, have been dispensed with, owing to bad trade.

In stating that this tendency of power station work to ebb and flow with the trade tide will remain with us, it should be remembered that up to the date of the war, the power station capacity, even in the best-served districts, was much below the power-absorbing capacity of the community.

Even during times of most severe trade depression, there were always a few people installing electric light; whilst in pre-war trade depressions it was the rule for many firms to look round at their ancient driving arrangements, call in an expert, and ascertain exactly where and how they could save by electrification. On this account the load was always progressive, even if only mildly so; it was therefore neither needful nor prudent to reduce the technical staffs of power stations in those days.

The fact to be remembered and insisted on is that in pre-war days the public supply of electricity only served a small proportion of the power demand; to-day the reverse is the case.

During the war, factories were built and electrified, and run from the public supply mains as the quickest means of getting the factory running; to cope with this demand, stations were extended enormously; and plant was put down with the firm belief either that the war would last for ever or that trade would expand each year at an ever-increasing rate.

As a consequence of this policy, we have up and down the country, power plants containing large capacity generating sets and no work for them to do. In several cases the whole present power demands of the district could be supplied through the plant which saw the station through the war; whilst the newer installation is not only not wanted, but is in such large units that there is not sufficient work to provide an economical load for these sets.

The present situation, then, is one in which so many works in every district are run from the mains, that a bad trade slump at once cuts off half the work of the station or stations supplying the district; the output of energy diminishes, and with it the revenue and the ability to retain and pay an adequate technical staff.

The point is not that there are no fresh applications for power connections coming in, but that the existing connections are not being used.

It is on this account that the mains engineer is in a rather stronger position than his station colleague; mains work must go on even if the load has been reduced by two-thirds; but a concern having two or more stations can, and must, close one or more stations when the demand goes down drastically.

The case of the men attached to a waste heat station is of course obvious if their particular source of waste heat either closes down, or goes on to short weeks.

In bygone days, when lighting was an important percentage of the total output, and when the power load was smaller than the traction load formed by the district tramways, such conditions made employment sure and constant.

The question arises how the altered situation can be met.

The immediate need of those on the unemployed list can be satisfied by a general whip round each month or two; such a contribution should be made permanent, however, for it will be wanted at every ebb of the trade tide.

There are too many men in the profession; and steps should be taken not only to discourage youngsters entering the line, but to ensure that if they do enter it, they are adequately trained both mechanically and electrically, and so able to leave the power-station industry as chances occur.

The first method was practised many years ago by the navigating officers of the merchant service, and did a very great deal to end an intolerable situation, in which men with masters' certificates were often serving as junior mates in their late thirties, and many a man with an officer's qualifications sailed before the mast.

The publication of the poor prospects of the profession in return for a very trying life, so stopped the flow of junior men passing for second mate, that the shipowning fraternity were compelled to give better pay and conditions to get men. It has been by resorting to similar tactics that the teaching profession has created a dearth of male teachers, and so assisted to improve their prospects.

The second point—the insistence on a thorough training—means that men must be made to come into station work through the shops; at least three years should be spent on such work as turbines, reciprocating steam engines, or gas- and oil-engine work, with as much millwrighting as can be managed. Another year should be spent in a winding shop.

If a youth leaves school at 16, this will make him 20 years old, and he will then be able to benefit from, say, 18 months' hard work in a power-station boiler-house. In the year between 21 and 22 he should serve on the switchboard for six months, and by the age of 23 he will be a passable all-round junior engineer.

The present system of training youngsters, in those stations which accept apprentices, is one-sided, and only to the advantage of the station; it leaves the youngster at the end of his apprenticeship little more than a glorified switchboard attendant, and tied absolutely to the one department of the one line he has experience of.

In travelling about on business, the writer has been appealed to by far too many youngsters of this type during the last twelve months for the experience to be forgotten. It is not pleasant to have to draw from an intelligent youngster of 22 or 23 the fact that he has done nothing but switchboard work, and to tell him that you cannot at the moment see any prospect of helping him.

These men are a danger to the station engineer; he will either have to provide for their keep during out-of-work periods, or see them as potential supplanters in the case of a serious dispute.

Were these men trained properly, they could, and would, get out of the station line during good times and into large works as assistant power and plant engineers; they would thus automatically prevent the overstocking of the junior ranks, and, above all, would be much more useful men than the purely station-trained man.

Unless some such steps are taken, the positions in the boiler house will have to be filled by men recruited largely from the sea-going engineers; and as the boiler house is the place in which money is either saved or lost, and on which the station depends for its low costs, this post is bound in course of time to become the senior post on the station. Other men may of course hold other opinions, but the writer feels convinced of three outstanding facts with regard to the station engineer: He must recognise that his job is no longer safe from trade fluctuations and the risk of unemployment. He must organise, to keep down the rush into the profession, and in turn see that suitable men are trained thoroughly. Above all, he must stick to his association, and bring about the suggested reforms through its assistance. In fact, at no time has there been greater need for the station men to hold together and to their association.

HIGH-POWER MERCURY ARC RECTIFIERS.

By R. L. MORRISON, A.M.I.E.E.

(*Concluded from page* 390.)

Three-Wire Systems.

With the rectifier it is unfortunately not possible to divide the pressure on a three-wire system and consequently the usual course is to connect across the outers and deal with the out-of-balance in some other way. By doing this, one of the principle qualities of the rectifier is retained, namely that of high efficiency, because if the alternative course of putting a rectifier across each side of the system is adopted, not only would the efficiency be lower but the initial cost of the plant would be increased. It is therefore advisable to balance either by means of a small rotary balancer or a battery, though in many existing systems the plant already installed and in parallel with which the rectifier would have to work, is quite capable of doing this.

Efficiency and Power Factor.

The efficiency figures already indicated have reference to the rectifier proper only. The overall commercial efficiency must, however, include all losses in the auxiliary gear such as main transformer, excitation, vacuum pump and reactance coils. Due to the comparatively small losses in the rectifier itself it is possible to give overall figures which are a good deal better than what can be obtained with the rotary converter under similar conditions and assuming d.c. working pressures above about 400 volts, though it is possible in many instances where lower pressures are met with to prove the rectifier to be the better converter if the average load over the whole run is considered, especially where a plant may be running for long periods lightly loaded. As frequency has no bearing on the operation of this type of converter, it is of advantage to use the higher frequencies because of the lower initial cost of the auxiliary gear and the benefit of the lower losses that result.

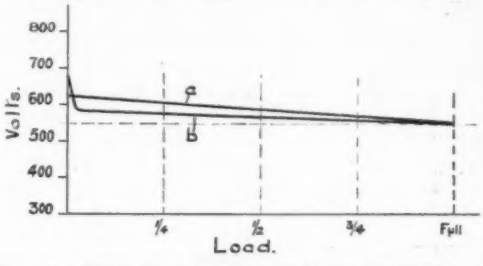

Fig. 11.—Regulation Curves for Standard Rectifiers.

A series of curves have been plotted (fig. 12) showing the relative efficiencies of complete rectifier equipments as compared with other converters of equivalent rating. The curves for the sets operating at 1,500 volts d.c. very clearly illustrate the improvement that results as the pressure rises, which is due to the losses in the rectifier remaining constant irrespective of the kW output dealt with.

The test results obtained with the three-cylinder rectifier set at Berne, installed early in 1919, are given in fig. 13,

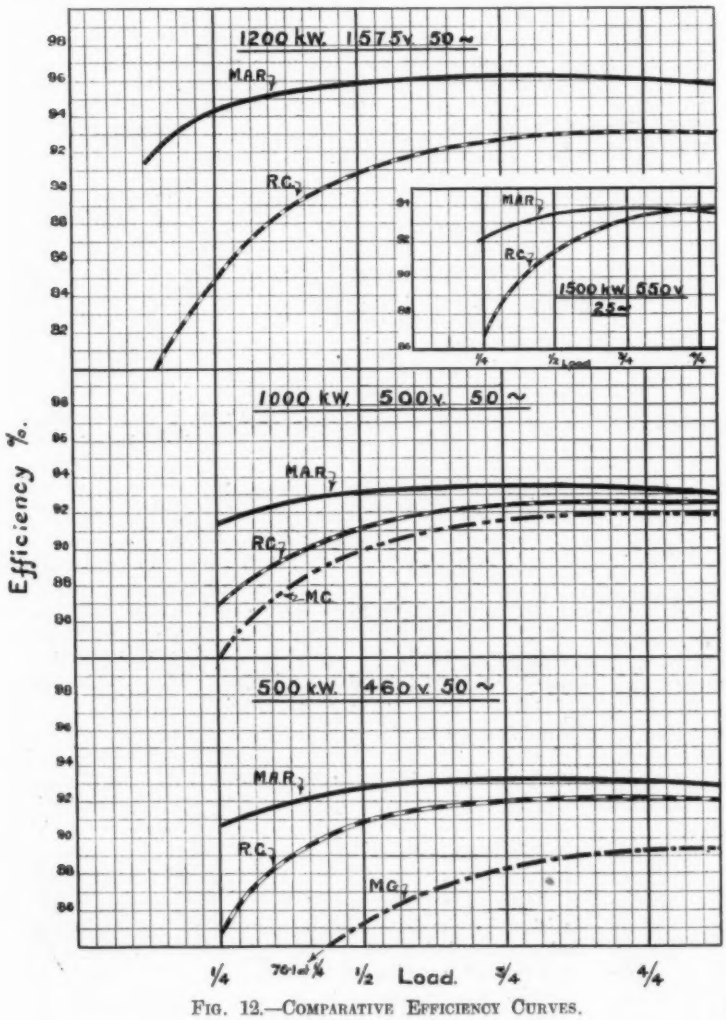

Fig. 12.—Comparative Efficiency Curves.

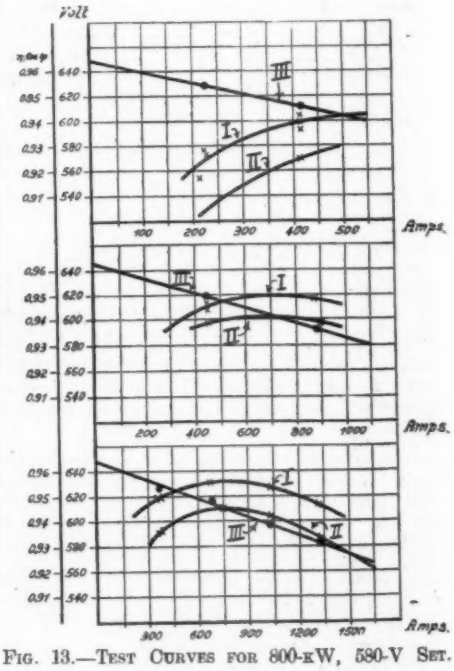

Fig. 13.—Test Curves for 800-kW, 580-V Set.

I, II, and III representing efficiency, power factor and regulation respectively. The figures were obtained for one, two and three cylinders operating in parallel with the tramway system and include all losses. The best results are naturally with the three cylinders working together, the highest efficiency

vouched being 95.5 per cent., which is some 2 per cent. higher than was guaranteed. It will be noticed that the power factor varies roughly between 93 per cent. and 95 per cent., and is

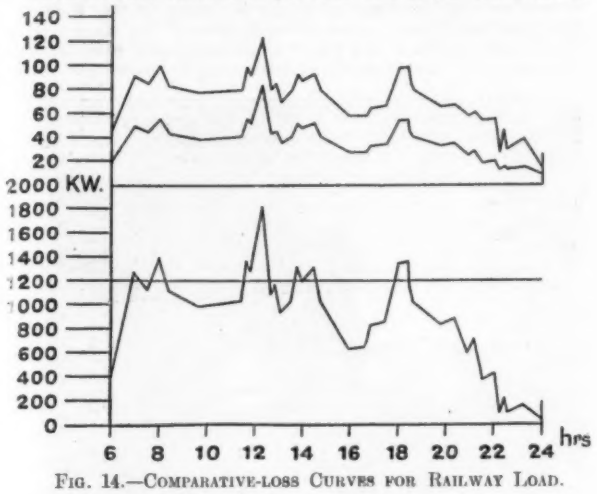

Fig. 14.—Comparative-loss Curves for Railway Load.

what might generally be expected for all similar rectifier equipments. The regulation curve, No. III, shows a drop of about 10 per cent., which is that for which the plant was designed in view of its having to run in parallel with motor generators in the same sub-station.

In this matter of efficiency the rectifier shows up to considerable advantage if a typical case is taken and the annual saving to be effected is worked out on the basis of the daily load curve. By way of example the losses for the 1,200 kW, 1,500-volt sets shown in fig. 12 have been plotted in fig. 14 for an actual railway load, rectifiers and rotary converters both being of Brown-Boveri manufacture and designed for a 50-period supply. The space included between the two upper curves represents the difference in the losses of the two types of converter and, if this is averaged out over the 18 working hours it will be found that those for the rotary converter exceed those for the rectifier by about 650 kW-hours, representing an annual loss of some 237,000 kW-hours. An additional advantage with the rectifier is that its efficiency has a tendency to increase after the plant has been in use for some time, mainly due to the drop in the arc decreasing as the vacuum improves.

Layout of Rectifier Plants.

At a d.c. pressure of 550 volts the outputs would be 330, 660 and 990 kW for the three standard sizes manufactured, and would vary up or down from these figures according as the pressure is above or below that mentioned. In view of the cylinders and pump set being at a potential above earth very slightly below that of the d.c. working pressure, it is now customary to completely enclose them in a substantial expanded metal screen instead of the old method of simply railing them off. The insulated vacuum cock and cooling water controls are operated from the exterior of the screen so that it is impossible for the attendants to come into accidental contact with live parts.

The lay-out of rectifier equipments is an extremely simple matter. A typical set with its transformer, switch panel, &c., having an output of 500 kW at 550 volts is seen in fig. 15, while a photograph of the same set is reproduced in fig. 16. The absence of foundations is a noticeable feature. The cooling water is circulated by a 0.5 h.p. motor-driven centrifugal pump, through the radiator coolers seen mounted on the staging above the rectifiers. These coolers are provided for all plants supplying traction or other loads where one pole of the system to which the rectifier is connected is earthed, or where the d.c. pressure exceeds 600 volts, the object being to eliminate the effects of electrolysis. It is also advisable to use the re-coolers where the fresh water supply is of an unsuitable quality. For the usual Corporation three-wire systems in this country the ordinary town water supply is invariably suitable, the quantity required being very small and amounting at the most to a pint or two per 100 amperes d.c. per minute at an inlet temperature of about 60 deg. F.

Maintenance and Attendance.

With the rectifier the question of maintenance scarcely

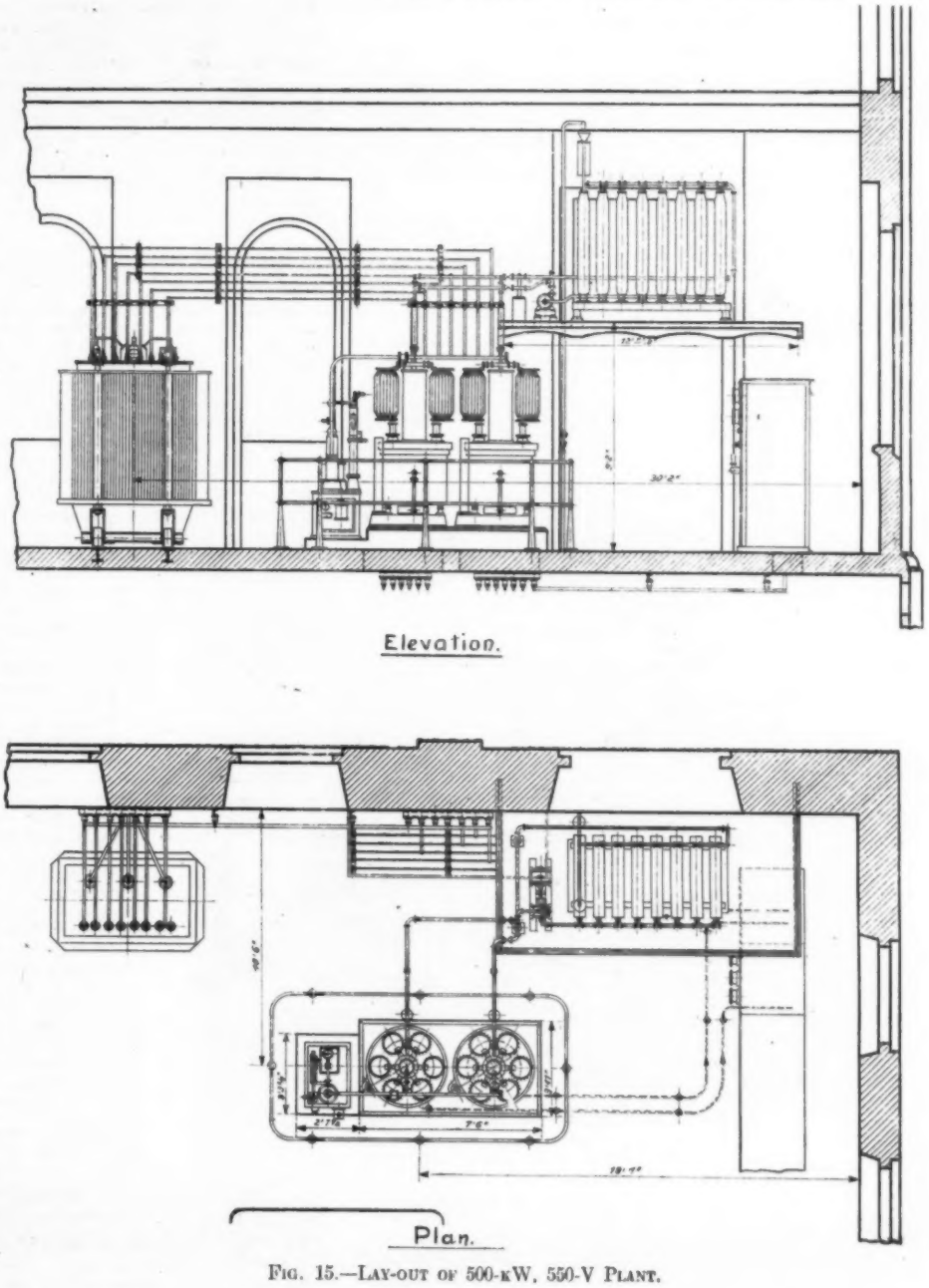

Fig. 15.—Lay-out of 500-kW, 550-V Plant.

need be considered because the plant is a stationary one with the arc operating in a chamber from which the air has been completely evacuated. Consequently, in the ordinary way there is no deterioration of either anodes or mercury and in general the only replacements that may be necessary are insulators and washers that have been accidentally damaged. Such a contingency is, however, very remote and in most of the plants installed by Brown-Boveri the cylinders have not been opened up for years.

While the rectifier is, by virtue of its construction, the nearest approach to the ordinary static transformer that it is possible to have, yet it does not possess in the same degree the outstanding advantage of the latter, that of being able to dispense entirely with attendance. This is, of course, only in its present stage of development but what can be even now definitely stated is that the little attention that is desirable need be comparatively unskilled. The attention required is not continuous but takes the form of periodical supervision. In consequence of intensive study and the improvements that are being constantly effected, it is confidently anticipated that before long this question of attendance will be definitely solved, especially by the introduction of semi-automatic control. Even now if completely automatically controlled only very occasional supervision would be required.

Advantages.

Briefly summarised, the following are the inherent advantages of the rectifier when compared with other classes of converter.

(1) High efficiency over a wide range of output.

(2) Simple operation and little attention.

(3) High overload capacity and insensibility to short-circuits.

(4) Negligible maintenance.

(5) Low weight and no special foundations necessary. The rectifiers can now be fitted with rollers and in consequence the usual cranes can be generally dispensed with, other simpler and cheaper lifting tackle being provided instead.

(6) Absolutely noiseless and vibrationless operation of the rectifier proper. The usual hum of the transformers is, of course, present, while the vacuum pump, when in use, can be heard a little. Consequently rectifier sub-stations can be erected in crowded areas without the locality being aware of their existence.

(7) Where new sub-stations have to be built these need only be of very light construction.

General.

To indicate the expansion of rectifier sales it may be stated that in spite of the depressed condition of trade last year the output ordered during the first six months was in excess of that for the whole of 1920.

Practically any kind of load can be handled by the rectifier. Installations which have already been executed or are in course of construction are principally for full-gauge railway work, tramways, and lighting and power. The range of pressures for which rectifiers have so far been designed is from 110 to 1,575 V, a large majority being between 440 and 660 V.

The initial cost of rectifier equipments where d.c. pressures up to about 500 volts are concerned is usually a little higher than that of a rotary converter equipment of the same size. The higher efficiency and lower maintenance and attendance charges with the rectifier, however, easily outweigh any difference that may exist. The case automatically alters when the higher traction pressures of 1,200-1,500 volts are reached—thus for 3,000 kW sets transforming from three-phase at 10,000 volts and 50 cycles to direct current at 1,500 volts, the initial cost when compared with rotary converters designed for the same conditions is in the proportion of 170 to 214, both plants being of the same manufacture. These figures in each instance include everything from the h.p. terminals of the transformer to the d.c. bus-bars.

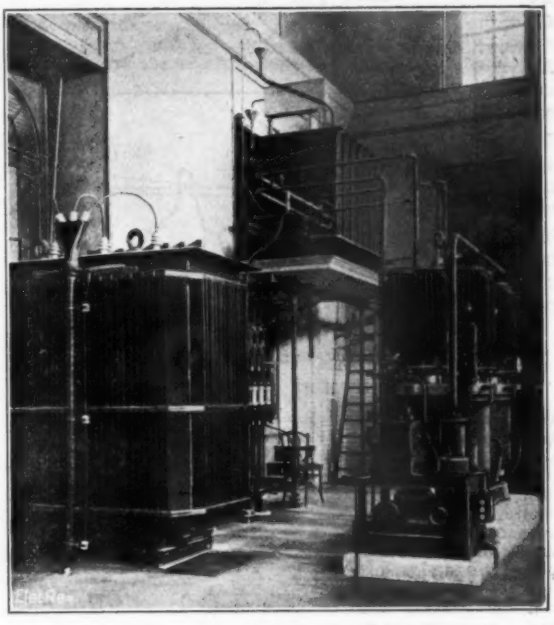

Fig. 16.—500-kW, 550-V Plant.

Several sets for dealing with 1,100 and 1,200 volts have already been supplied, while a recent contract obtained from one of the French railways provides for sixteen 1,200-kW sets at 1,575 volts d.c. A 1,200-volt traction set that has been in completely successful operation in Sweden since April last year is seen in fig. 17. Higher d.c. pressures than about 1,600 volts would at present have to be obtained by connecting two rectifiers in series. It is anticipated, however, that as a result of the experience at present being gained and the researches being carried out that it will be possible to go to 3,000 volts with perfect safety at no distant date.

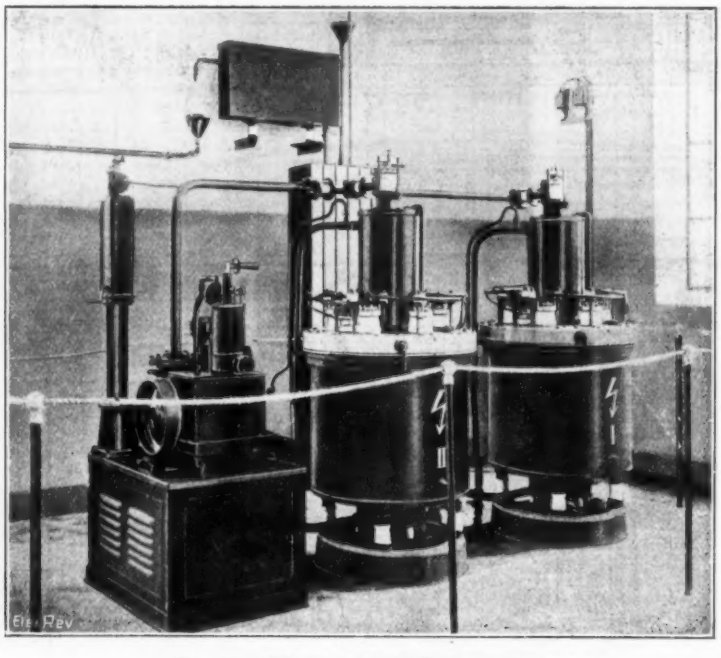

Fig. 17.—600-kW, 1,200-V Traction Set.

In appearance rectifier equipments are always very pleasing. This is clearly seen in the view given in fig. 18, which shows a set of six rectifiers in line, put into commission last year on the Continent, four being in use on the town lighting and power supply, and two on the traction system.*

In conclusion, the author desires to express his acknowledgments and thanks to his company (Messrs. Power-Rectifiers, Ltd.) for the facilities and information given him in connection with the preparation of this article, and also to Mr. A. Odermatt (chief engineer of the rectifier sales department of Messrs. Brown, Boveri & Co., Baden, Switzerland), for many valuable data and much assistance placed at his disposal for the same purpose.

Scandinavian Power Transmission.—The report of the Scandinavian Joint Commission which was appointed last year to consider the question of the electrical transmission of power from Norway to Denmark is expected to be completed in the summer. The electrical section of the Commission is on the point of reassembling in Stockholm.

*See also Electrical Review, October 14th, 1921, for a description of the first rectifier installation erected in this country—that at Ipswich.—Eds.

SIAM: A GROWING MARKET.

Imports of electrical goods and apparatus into Bangkok (Siam) during the last financial year (1920-21) totalled about £110,000 in value, as compared with £122,000 in 1919-20, and £87,000 during the preceding twelve months. Of machinery, including machine tools, the values imported have been: £102,000 in 1918-19, £173,000 in 1919-20, and £443,000 in 1920-21. It will be seen, therefore, that the market is of considerable interest to the engineer.

The general trend and future possibilities of this trade are described in a report by H.M. Consul-General at Bangkok, which has recently been issued by the Department of Overseas Trade. For many reasons the market is worthy of attention. The country is rich in resources, and is expanding rapidly. It is true that it suffered during the international

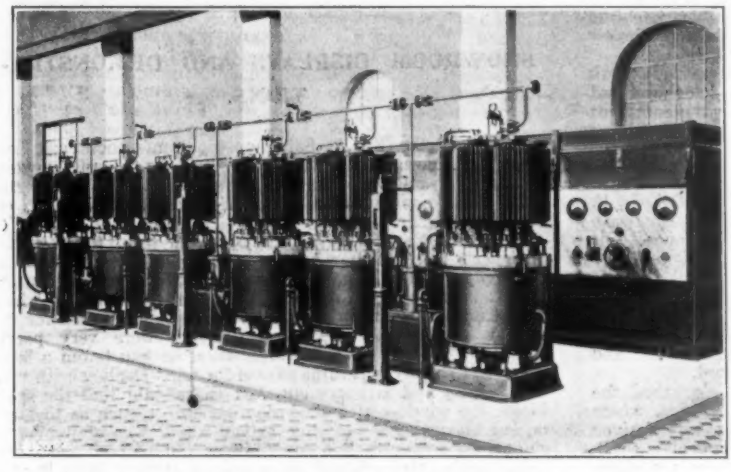

Fig. 18.—Six Rectifiers Operating in Parallel (see p. 426).

slump which occurred after the Armistice, but, on the other hand, importers did not over-purchase, if the volume of goods bought from abroad, rather than their value, be taken into consideration. Further, the Siamese are well disposed towards British manufactures.

Take, for instance, metal goods. The value imported during the last financial year (1920-21) was £933,000, as compared with £692,000 in 1919-20. Of these £418,000 worth are credited to the United Kingdom, £61,000 to Hong-Kong, and £63,000 to Singapore. It is safe to assume that the last two represent, for the most part, goods of British origin. They consisted of railroad material, galvanised sheets, bars, sections and sheets, wire manufactures and nails (other than wire nails), and tin plates. The value of the imports of these goods from the United States was £246,000.

The share of the chief countries of supply in the electrical and machinery trade is shown below:—

Articles and Countries from which Imported.	Ticals. £1 = 13 Ticals. 1918-19.		Ticals. £1 = 11.28 Ticals. 1919-20.	
Electrical Goods and Apparatus.				
United States of America ...	Ticals	349,792	Ticals	464,464
	£	26,903	£	41,175
Sweden	Ticals	6,233	Ticals	266,291
	£	480	£	23,607
United Kingdom	Ticals	98,956	Ticals	264,295
	£	7,611	£	23,431
Other British Dominions ...	Ticals	31,354	Ticals	49,187
	£	2,412	£	4,360
Japan	Ticals	360,942	Ticals	251,171
	£	27,766	£	22,266
All other Countries	Ticals	278,036	Ticals	78,387
	£	21,391	£	6,951
Ticals		1,125,313		1,373,795
£		86,563		121,790
Machinery (including Machine Tools).				
United Kingdom	Ticals	245,447	Ticals	954,364
	£	18,880	£	84,607
United States of America ...	Ticals	764,499	Ticals	842,915
	£	58,808	£	74,726
All other Countries	Ticals	312,398	Ticals	157,591
	£	24,031	£	13,971
Ticals		1,322,344		1,954,870
£		101,719		173,304

In 1920-21 machinery and machine tools were, as stated above, imported to the value of £443,000, of which £312,000 came from the United Kingdom, the principal items being railway locomotives, rice milling machinery, machine tools, and marine engines.

ELECTRICITY AND AIRCRAFT.

The Air Conference.

The second Air Conference, called by the Air Council, was held at the Guildhall, London, last month.

Sir Charles Bright, F.R.S.E., represented the Institution of Electrical Engineers at the Conference, and moved a resolution to the following effect: "That (1) for the purposes of economy, the Navy, Army and Air Force be absorbed under a Ministry of Defence; and (2) that civil aviation—aerial transport in particular—be dealt with by the Ministry of Transport or some other civil department." The necessary notice not having been given, the resolution could not be put to the meeting in the usual way. It, however, preceded the publication of the Geddes economy report.

In his paper on the subject of "Airships," that was read at the Conference, Major G. H. Scott, C.B.E., A.F.C., A.M.I.Mech.E., expressed the opinion, with regard to weather conditions and electrical disturbances, that the chief danger in an electrical disturbance was not, as was generally thought, due to lightning, but to the very violent air currents, that might bring excessive strains on the hull structure. It was, however, with the present meteorological organisation, and with present air knowledge, comparatively easy to avoid thunderstorms. He could definitely say that thunderstorms in this country did not constitute a danger to airships, neither would they constitute a danger in the tropics, as with the development of airship routes the meteorological organisation would be extended to meet their comparatively simple requirements.

In his paper on "Civil Aviation," Lord Gorell, C.B.E., M.C. (Under Secretary of State for Air), explained that the Swedish Waterfalls Board opened in the summer of 1921 an air service between Porjus and Suorva, thus effecting a great saving in time, as the journey by land was difficult, in connection with the water-power installation. With regard to developments in wireless telegraphy and other signal work, direction-finding stations, working in conjunction, had been established at Croydon and Pulham and the combination of bearings from the two stations enabled pilots to ascertain their exact position. Improvements had been made in the system of ground signals at Biggin Hill and Croydon for indicating weather conditions; and important steps had also been taken to facilitate night flying. The Meteorological Office and the study of weather conditions must always remain a matter of the greatest importance to the airman. Before the war there was no national distribution or international exchange of meteorological information by wireless telegraphy, and practically the only method was by telegram, or, in rare cases, by telephone; now reports were collected from about eight stations in Great Britain by wireless telegraph and, supplemented by reports obtained in other ways, were distributed hourly by wireless from the Air Ministry. When the number of available wireless stations increased it should be by no means impossible to put into operation the scheme prepared by the International Convention for Aerial Navigation whereby a selection of all reports in collective form would be issued from a central national office within 1½ hours of the time of observation. The study of magnetic disturbances was an important one; as an interesting instance of the difficulties in connection with the selection of suitable observations, Lord Gorell mentioned the serious effect which the electrification of the London railways had had on the records at Kew, rendering them unsuitable for the more important investigations.

"The Progress of Research" was dealt with by Brig.-Gen. R. G. Bagnall-Wild, C.M.G., C.B.E., F.R.Ae.S., Director of Research, who explained that Dr. Ferranti was attempting to determine whether it was better to replace the carburetter system of a Taxham two-stroke internal-combustion engine by some method of direct fuel injection. One of the advantages expected to accrue if the experiment was a success, was the elimination of the ignition system, which would remove a source of unreliability and trouble. In connection with navigation in thick fogs there was always the possibility, given the right ground organisation, of detecting the position of an airplane by sound and of signalling to it by wireless when to glide down and in what direction, which had been done successfully at Croydon. Suggestions had been made to get rid of fog, either by mechanical means or by electrical discharges; however, for an aerodrome of normal size the cost of those methods was prohibitive.

The study of directional wireless was being steadily pressed forward; a particularly promising form was the rotating wireless beacon; that method offered the very considerable bait of freedom from the troublesome quadrantal error, but it, like

other wireless methods, depended for its ultimate accuracy on a careful study of the conditions which determined the nature of the path followed by the waves.

Major Fred M. Green, O.B.E., M.Inst.C.E., F.R.Ae.S., took as his subject "Research from the Designers', Constructors', and Users' Points of View," and in the course of his paper observed that there were many ways in which wireless telegraphy and telephony could help in navigation, but it was essential that the gear carried on the aeroplane should be as light and as simple to use as possible. The important thing was to convince the pilot himself that the gear with which he was provided was absolutely reliable. Wireless control of the aeroplane itself from the ground was certainly a possibility of the future, and it might be that the pilot of an air liner would give up the control of the aeroplane when within a certain distance of his landing-place to a ground pilot, who would bring the aeroplane into port.

Lt.-Col. W. A. Bristow, M.I.E.E., M.I.A.E., F.R.Ae.S., read a paper on "Aerial Transport, To-day and To-morrow," and explained that experience had shown the meteorological and wireless services to be the twin guardians of safety in the highest possible degree. Times innumerable machines had been saved from danger by the timely warning by wireless telephone of sudden changes in the weather conditions.

The services of the Marconi Co. and the constant work of its able staff on the development of wireless telephony had been of the very greatest value, and the improvements that had been made were of a most substantial and gratifying nature.

The Use of Light as an Aid to Aerial Navigation.

A paper on the above subject was read by Lt.-Col. L. F. Blandy at the recent meeting of the Illuminating Engineering Society, when the chair was occupied by General Sir Frederick Sykes, Controller-General of Civil Aviation.

In the introductory portion of the paper Lt.-Col. Blandy briefly described the searchlight equipment in use around London for anti-aircraft operations during the war. It comprised both stationary searchlights, chiefly taking 50 amperes, though ultimately some 150-amp. types were introduced, and motor-lorries on which generators were mounted.

Turning to peace developments, the author described the arrangements for lighting aircraft of the R. 36 type, which was lit internally by 12-volt lamps. Energy was derived from five generators belt-driven from the main propellor shaft, charging a 40 amp-hr. battery. For the passenger accommodation 48 lamps of 8 c.p. each were used, and other lights were assigned to the control car, power car, wireless cabin, &c.

External lights had already been dealt with by the International Convention for Aerial Navigation. They included a white forward light (8 km. range), a green light on the right (5 km. range), and a red lamp of similar range on the left. Special design was necessary to prevent the green light being seen from the left, or the red light from the right. A white light must also be attached to the rear (also 5 km. range). Actual examples of such lights were exhibited at the meeting and it was mentioned that some difficulty had been experienced in obtaining constancy of colouration for the glasses used for the red and green lights. In view of the high speed at which modern aircraft travelled, navigation lights were of obvious importance, and the present range might have to be increased. Thus, if two aircraft, each travelling at 100 m.p.h., meet in mid-air, the period of time from sighting the lights to collision was only 90 seconds for the headlights and 50 seconds for the side lights.

Another form of light carried on board was used to facilitate landing. Chemical flare lights had been used for that purpose, but more recently electric lamps had also been developed. Such lamps might be used in reflectors and mounted on the machine structure. In France varied designs, comprising electric wing-tip lamps, fuselage lamps, and clusters of lamps mounted low down under the fuselage, were adopted. Ultimately gasfilled lamps of 1,000-2,000 c.p. were developed for that work, and as those lamps were run off a 12-volt battery and took 50-60 amperes, they had to be of special design and involved various problems, notably the sealing in of electrodes carrying such high currents. There was a consensus of opinion that, for landing, the electric lamp was as good as the chemical flare, and it had special advantages, such as the fact that it was under control and could be switched on and off for a definite period.

Aerodrome lighting involved lights used to indicate obstructions, illumination of the actual landing ground, and fixed illuminated signs to indicate the direction of the wind, &c. High wireless masts formed dangerous obstructions, and required to be lighted with special care. At Croydon and Lympne 60-watt lamps were placed at intervals along the ridges and highest points of roofs, masts, &c. The lamps were enclosed in watertight fittings with outer red glass, and that display of red lights afforded, incidentally, a good means of recognising the aerodrome. At the top of the very high wireless masts 1,000-watt gasfilled lamps, with a red outer cover, were placed, and also down each leg of the mast. The marking out of landing places had been the subject of much study, one important point being the mounting of lamps in reflectors giving the necessary wide angle of visibility. One arrangement favoured for the purpose of marking-out landing areas was the arrangements of lights in the form of "L's," and such lamps were controlled by special revolving switches, so as to indicate, by the effect on the lamps, the direction of the wind. Searchlights had also been proposed and experimented with to facilitate landing. But when the machine was alighting the shadow-trouble was apt to cause difficulty and the method was considered unsafe. Searchlights might, however, prove of value for the actual lighting of the ground.

In the concluding part of the paper the author described various forms of aerial lighthouses, a feature of which, as contrasted with marine lighthouses, was the wide angle through which the light required to be recognised. Experience had shown the need for a practically homogenous light throughout 180 degrees and the avoidance of any "dark spots" had proved more difficult than might at first sight be imagined.

An appendix to the paper contained a summary of the recommendations of the International Convention with regard to lights used for signalling.

SHOWROOM DISPLAYS AND DEMONSTRATIONS.

The fifth of the E.D.A. Salesmanship Conferences was held on Friday, March 17th, when Mr. A. C. Bostel, of Croydon, read a paper on "Salesmanship in Relation to Showroom Displays and Demonstrations." Mr. H. Marryat, M.I.E.E., occupied the chair.

Mr. Bostel dealt with the subject from the central station engineer's point of view, and was firmly of the opinion that all supply undertakings, however restricted their powers might be, should have showrooms to demonstrate the uses to which electricity can be put. A large number of showrooms for the display of electrical apparatus, he said, were very poorly equipped, and even in some large stores he had found a large amount of shoddy apparatus offered for sale. Dealing with window display and arrangement, Mr. Bostel said that the space inside the window of a showroom should be such as to allow one or two examples of each article which was of use to be shown, so arranged that everything could be seen from outside. Each article should have a card, stating what it was, its price, and cost of running per hour or per operation. The display should be as varied as possible, and not overcrowded, nor mixed up with wiring accessories. The display should also be altered frequently to suit the seasons. He emphasised the importance of maintaining the lighting until about 11 o'clock at night, so that the display should not be hidden from the public when the showroom was closed. Outside lighting could also be demonstrated, but the outside lamps should only be switched on for demonstration purposes, as otherwise they would seriously contrast with the window display. Showrooms should be divided up into sections, each section being devoted to a particular purpose. The power section should have one or two direct-driven machines. Most manufacturers would be pleased to loan machines, provided their representative could bring his prospective client in. A small motor could be fixed, and means whereby a brake could be applied to the pulley, showing on a wattmeter connected how easily and quickly an electric motor adjusted its consumption to the load. A diagram on the wall showing the space occupied by a gas engine and tanks, compared with a motor of the same output, would be useful. An overload release should be in operation, showing how easily an overload on a motor was guarded against, the motor should be on slide rails to demonstrate the ease with which a slack belt was taken up, and it was very convincing to have a record of the average revenue received per b.h.p. installed of different classes of machine driving. It was wise not to have too many elaborate control devices about; these were things which could come in afterwards, it being remembered that the showroom was used for the demonstration of the uses of electricity to laymen, the majority of whom were interested only in what a motor would do and what it would cost. It was a mistake to show many different makes of apparatus, and a salesman should carefully investigate the various makers' goods, thoroughly test them, and decide which were best. Another section of the showroom should be devoted to lighting, and include a darkened partitioned cupboard showing the effect of various reflectors and different types of fittings, and the consumption of apparatus should be given. Then, if space permitted, a hall for 200 or 300 people should be set aside for talks and demonstrations. Mr. Bostel emphasised the importance of displaying plainly marked cards with the goods. The public should be encouraged to visit the showroom, not necessarily to buy, but to see what was on.

The greatest care should be exercised in the selection and management of a showroom staff. The necessary knowledge could be easily acquired by a young person of average intelligence, and the author said he found that girls possessing the necessary personality, appearance, and address made ideal assistants. It was important that the manager should always encourage his staff to keep up-to-date in their work.

All sales and moneys received should be kept distinct from the accounts for energy sold, so that an accurate record of the results of a department might be maintained. Particulars of each sale should be recorded, with the name and address of the purchaser, for the benefit of the outside staff.

Dealing with the investigation of complaints, the author pointed out how necessary it was to deal carefully with each one. To satisfy a consumer was just as important as obtaining new business. Finally, Mr. Bostel touched briefly on the qualities necessary in salesmen. The staff should possess tenacity of purpose, enthusiasm, optimism, and a deep belief in the goods they handled.

In the ensuing discussion, Mr. Page said it was important that inspectors, fitters, &c., should be equipped with the necessary knowledge to enable them to advise customers as to what was the best thing to use under certain circumstances.

Mr. Seaman spoke from the point of view of the ordinary contractor. It was often beyond the contractor to have a showroom of the size dealt with by the lecturer, and he suggested the stimulation of public interest by the holding of popular lectures on electricity and its uses. He also suggested that contractors in various districts should combine and run a permanent exhibition, supported by the supply companies in their districts. These exhibitions should be devoted to demonstrations, and there should be no sales, but pamphlets containing the names of the contractors should be available. He expressed himself as very much against manufacturers opening showrooms themselves, and also urged that supply authorities should supply power to contractors at a nominal rate.

Mr. Young said that the three problems before contractors were to get showrooms open, to get the people into them, and to sell the goods when the people were in. As to the latter, salesmen were very energetic and enthusiastic, but it was essential that they should always be natural, sincere, concise, and should always speak the truth. Getting people into the shops was a difficult matter, and he would like to find some easy method of doing this. He himself had found that silk shades in a showroom window attracted attention. There were not enough showrooms open, and the electrical industry was suffering to-day from the fact that the goods were not being shown to the public. He had spent a great deal of money on showrooms, but there had been no profit on them, but he believed the time was now at hand when profits would be made. He complained of the difficulties contractors had to face through manufacturers giving discounts to the public. Some manufacturers, on the other hand, asked their customers the name of their contractor, and if cash were paid for the apparatus sold, they would credit the contractor with his discount. If the industry were to develop, as it should, then the retailer must be encouraged.

Mr. Mann said that his firm had a showroom, and it had paid, because people came in to see the appliances exhibited, and were not pressed to buy, but the majority of them came back for their fittings, &c. With regard to saleswomen, he was of the opinion that they should be encouraged, because they were a help in dealing with their own sex.

Mr. W. A. Gillott asked how many contractors were able to thoroughly demonstrate all classes of cooking and heating apparatus in their showrooms. In his opinion there were very few. His firm (Jackson Electric Stove Co.) had a showroom which was mainly used for educational purposes. If anyone came into it he was asked for the name of his contractor, and if the client paid cash for whatever he had purchased the contractor was informed that a discount had been placed to his credit. No purchasers, except those connected with the trade, were allowed discount. He was not sure that he was in favour of exhibiting the price of each article; it was better to tell a customer how much a machine would cost to run.

Mr. Hughman pleaded for more co-operation, especially among contractors in their own districts. He suggested that a number of contractors in a provincial town should come together and run a co-operative showroom. They could pool their capital and goodwill, and form a small company, or go into partnership.

Mr. Bush advocated the changing of window displays frequently and also dealing with one kind of article at a time. This would create interest, and people would be more inclined to inspect the other goods. It was advisable to make a display look seasonable. He did not see why manufacturers should loan goods to contractors. Contractors did not carry enough stock.

Mr. Calvert leaned towards the display of clearly marked groups of articles in the windows, with price tickets, because if they concentrated on one type of article for, say a week, people would get tired of it and walk past. He did not think lady saleswomen in contractors' showrooms were a success.

Mr. Robinson (Croydon) pointed to the difficulties of a suburban contractor. People who lived in Croydon would not select goods in Croydon, but would go to the big London stores for them. Suburban contractors did much educational work, whereas the stores were only interested in selling, and not in the efficient working of the apparatus.

Mr. G. Leevers (Hotpoint Electrical Appliance Co.) said that he had always been struck by the fact that in a municipal showroom there was usually nothing to indicate that it was an information bureau. Supply authorities never seemed to allow the public to see their generating stations. This should influence the public, because the air of safety and efficiency and cleanliness in a generating station would impress them.

The Chairman, dealing with the organisation of public lectures, &c., to further public interest in electricity, said that the E.D.A. was considering this matter at the present time, and hoped to do more. It chiefly remained for contractors, manufacturers, and supply authorities to provide the necessary funds. He also referred to the activities of the Electrical Contractors' Association with regard to the opening of showrooms.

Mr. Bostel, replying to the discussion, said it had not been his experience that inspectors, &c., were more enlightened than the salesmen, and could deal with consumers better. At Croydon they had inaugurated a scheme whereby these men were given commission on any new business they might introduce, but the business obtained was very small, and the information given by the men was bad. He had given lectures in the public libraries in Croydon, on the uses of electricity in the home; these were fairly well attended, but by the sort of people who wanted something for nothing, and the amount of business arising from them was small. In Croydon contractors had been supplied with energy at nominal rates, and it was a practice which should be followed throughout the country. The practice in Croydon was to have a small standing charge, and then supply at 1d. per unit, and it had induced contractors to make a better show. Much had been said with regard to manufacturers lending goods. In his opinion, manufacturers were only too eager to push things into the showroom. He was in favour of inviting the public to view the supply station. In conclusion, he expressed the opinion that the future of the industry lay in co-operation with the contractors.

The Chairman announced that that completed the session's salesmanship lectures, and it was hoped that another series would be held next session. It would be an excellent thing for the industry if the movement could be extended to the provinces.

Mr. J. W. Beauchamp (director of the E.D.A.), responding to a vote of thanks, said there was one feature in everything the E.D.A. undertook, and that was that all associations in the industry were represented.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Switching Certificates.

As the originators of the competitions under which the above certificates are awarded, we were naturally interested in the letters which appeared in your issues of December 30th, 1921, and January 13th, 1922. Regarding the query of "Intermediate," modesty forbids us to state our opinion as to the value of the certificates to their holders; sufficient to say that, as the examinations have been held continuously during the past nine years, and as there appears to be no falling off in the number of would-be holders, it suggests that they must carry some recognition in the trade. During this time, in spite of the war, we have received some 3,000 entries, and of this number nearly 2,000 have succeeded in obtaining certificates.

The question papers are answered in a man's leisure time, and at his own home, and the answers, taken as a whole, show intelligent work and initiative. In awarding these certificates, the idea was to provide some tangible recognition of the work done by the holders, and, as Mr. J. C. Tree points out, not with a view of giving any guarantee that holders would obtain employment on their production. Notwithstanding this, many have written stating the benefits they have directly derived through taking part in the examinations. It appears that "Intermediate" must have struck a bad patch, as there are very few contractors at the present time who are not fully alive to the great advantages of modern switch controls, realising that an employé having this knowledge is an asset to his firm. There is no doubt but that anyone taking part in the examinations must extend his knowledge, as in answering the questions a fair amount of initiative is required.

Incidentally, educated and up-to-date workers will naturally bring benefit to *all* branches of the industry, and it is satisfactory to note that enterprising contractors recommend their employés to improve their knowledge by entering for the examinations.

Thanks are due to the late Mr. W. Perren Maycock, M.I.E.E., for the systematic manner in which he organised the scheme and controlled the examinations until his death. His enthusiasm and ability were most useful factors towards the success attained, and we are as fortunate in his successor, Mr. W. H. Bray, A.M.I.E.E., one of the most successful

teachers of electrical engineering and electrical installation work in London. The City & Guilds of London Institute did excellent work with its system of examinations in electrical subjects, but now, after 40 years' existence, all that remain are the examinations in the Honours Grade, those previously held in the earlier grades having been cancelled some three or four years ago at the request of the Board of Education. When the Board of Education decided on the cancellation of the City & Guilds examinations, our own Institution would have been well advised to have then introduced an examination scheme suitable for the artisan. Such a scheme would have been of great benefit to the industry, and the certificates awarded would have received greater recognition than those of the City & Guilds.

We think that where any contractors have stated that the knowledge possessed by "Intermediate" is of little use, they must have had very hazy ideas of the whole scheme. We are, therefore, willing to send to any contractor on request a set of three current question papers, in order to prove to him their real practical nature, and think, after perusal, he will agree that the questions are practical and by no means easily answered.

At the time of writing, it is with great satisfaction we hear that examinations in Grade I of "Electrical Installation Work" are to be reinstated for this year.

A. P. Lundberg & Sons.

London, N.7,
March 15th, 1922.

[Abbreviated.—Eds. Elec. Rev.]

A Combination Fan and Heater.

I was very much interested in Mr. H. Ashdown's letter in your issue of the 3rd inst., and would state that I obtained a Provisional Patent for a combined fan and heater on February 26th, 1921 (No. 6469), which is several months prior to the date of Mr. Ashdown's Provisional Patent. This is a fan capable of emitting either hot or cold air in any desired radial direction. When hot air is required, the fan can be regulated to a wide range of slow speeds, whilst for cold air the fan is used in the usual manner giving full speed with three regulations.

Probably, however, someone can quote the date of a similar patent prior to mine.

Arthur Charles,
Managing Director,
Burnley Components, Ltd.

Burnley,
March 18th, 1922.

Iron-Nickel Accumulators.

There are some places for which lead accumulators are not quite suitable, for instance, some country-house batteries and starting batteries in motor-boats—in both these cases the batteries are often left idle and uncharged for months.

I should be much obliged to any of your readers who have had experience of iron-nickel accumulators in similar situations, if they would let me know how these compare with lead batteries.

R. P. F.

March 18th, 1922.

The Cost of Living in India.

From time to time you ask for and publish letters dealing with conditions of living abroad, and I take this opportunity of forwarding some cuttings from the *Statesman*, which is Calcutta's leading newspaper, and is said to have the largest circulation of any daily paper in India.

I quite fully bear out what the correspondents say, and should advise any married man coming to this country to be more than careful in his inquiries before making the final plunge. It is an absolute impossibility to live in Calcutta (and I believe practically the same conditions prevail in any other Presidency town and Rangoon, &c.), on less than Rs.1,000 a month, for a married man without children, and this does not allow for any saving or provision for trips to the hills for the wife or oneself; these are a necessity at least every other year for the wife.

I can assure all your readers that the trials and discomforts, &c., of this country are most decidedly not "worth the candle" unless one is able to save at least one-third of one's salary. If any reader is contemplating coming to India and cares to write through the Editors, I shall be pleased, at any time, to supply him with the actual figures of an average married man's expenditure in this city.

To cap all, the present taxation proposals of the Indian Government will add about 15 per cent. to the cost of living. I wonder if salaries will increase by the same amount!!

T. Jager, A.M.I.E.E.

Calcutta,
March 2nd. 1922.

[The cuttings referred to mention as causes of the trouble:—Exorbitant rents (in spite of the existence of a Rent Controller); the false standard of living which Europeans are compelled to adopt: as well as the high cost of essential commodities.—Eds. Elec. Rev.]

The Quick-make and Quick-break Switch.

With reference to the correspondence appearing in your columns regarding the above, the consensus of opinion undoubtedly seems in favour of a quick "make," provided that this ensures a full and satisfactory contact; not necessarily contact *area*, but contact with minimum watt loss.

To make the switch thoroughly satisfactory, the spring controlling this positive action should have ample margin to allow for fatigue and to ensure that the positive action is maintained throughout the life of the switch. The quick-make movement should be compulsory and quite independent of the speed of handle operation. If this is satisfactorily designed, it should not be necessary to have a "follow on" movement (except as an added insurance), and where this "follow on" movement is embodied in a switch as an essential part of operation, it would seem a confession on the part of the makers that the spring alone cannot be relied on to make a full and satisfactory contact, and that if the "follow on" motion was eliminated that contact would be unsatisfactory. This type of switch cannot be described as a real advance over the slow "make" hand-operated switch which certainly ensures a satisfactory contact.

It is surprising that purchasers of switches should always rely merely on the manufacturers' own rating of the switches, and that no tests or guarantees of performance are asked for. In other apparatus such as motors, transformers, &c., full guarantees of performance are always available.

R. R. Smith.

March 15th, 1922.

The *primary* feature of an ideal switch is its ability to carry the rated current throughout the life of the switch with a minimum watt loss. Any movement necessary to interrupt the circuit should, therefore, not interfere with this function.

The *secondary* object of the switch is to make or interrupt the circuit under full load with a minimum of sparking. It is, therefore, advisable that both the "make" and "break" should be, if possible, instantaneous and positive in action, and that no inching should be possible in either direction. If the "follow-on" movement by hand, is necessary to ensure full contact in the "make," it follows that it is equally necessary that the switch should be inched in the reverse direction when switching off to allow the spring to function. This is a common fault in many quick "make" switches, and it is, in our opinion, essential that the operator should only be called upon to provide the necessary power to compress the springs, making the speed of operation in both directions entirely automatic and positive; in other words, a "trigger action" should be provided.

As manufacturers of a quick "make" and "break" switch, we claim to have produced an apparatus embodying all the features mentioned above, and, in addition to this, maintaining the whole of these features under full-load working conditions in a satisfactory condition throughout its life.

Magnome.

March 15th, 1922.

The replies to my letter under the above heading which appeared in your issue of February 24th last have been most gratifying, and coming from manufacturers and designers of switchgear are very instructive and interesting.

The writer is of the opinion that most of the commercial switches on the market, from the tumbler upwards, are in practice switched on quickly, although not actually quick-make switches. The time element in switching on or closing an ordinary switch, as against a quick-make switch, is only a matter of a fraction of a second, so that in practice it would appear that most, if not all, switches have the benefit of a quick-make to all intents and purposes. There is no desire or inducement for an operator, skilled or unskilled, to purposely make slowly, so that I think the time taken in actually making the circuit with a so-called slow-make switch as against a quick-make switch is almost negligible.

I am inclined to agree with the letter from "Switcher" in your issue of March 17th when he says: "I consider that with a well-designed slow-make switch this partial contact would in most cases be as good as the normal contact of the quick-make switch." that is, assuming the slow-make switch was not quite closed.

With regard to ironclad switches with a lever protruding through the cover, there are undoubtedly a large number of cheap and badly-made switches on the market, and the burning of contacts, &c., is mainly due to faulty mechanical design. The writer knows of one electrical inspector who, when examining plant, is never satisfied when the switch is in the so-called "off" position without first opening the box to satisfy himself that the switch is actually "off." He informs me on many occasions when the lever is in the "off" position and the cover has been removed, he has found one pole still in partial contact; owing to flimsy mechanical design, both blades or poles do not always work together, and the position of the operating lever is therefore not always a guide to the actual position of the switch.

However, there are points in favour of both quick-make and

slow-make switches, and from the correspondence which has followed, it would appear that there are quite a number of manufacturers offering excellent switches of both designs.

C. W. Denny.

London, S.W., *March 20th*, 1922.

Technical Workers' Salaries.

I notice in this week's "Personal Column" of the ELECTRICAL REVIEW that a borough electrical engineer is complaining that his present salary is only 24 per cent. in excess of his pre-war salary. If his case is considered hard, what might be said of a senior technical assistant employed by a great Institution very closely (need it be specified how closely?) allied to the electrical industry, who is in receipt of a salary which is only 8 per cent. above the pre-war rate; the last occasion that an increase was conceded having been somewhere in the early days of the war?

Yet this is a fact.

Assoc. Memb.

March 14th, 1922.

The Walkerburn Hydro-Electric Scheme.

The question of storing water power has engaged the attention of water power engineers for some time, and your description of the above plant has no doubt been read with much interest, though to many of your readers the question has no doubt arisen—"Was it worth while?" and it is this very question I will try to examine on the basis of the figures you have produced in your article. I fear, however, that if this installation is taken as a fair sample of what might occur elsewhere, many of your readers may consider, and rightly so, the capital outlay out of all proportion to the results obtained.

There are three methods by which hydro-electric power can be stored, viz., mechanical, electrical, and calorific or heat storage. Probably the mechanical method is the most efficient and yields the best results, provided they can be arrived at without undue capital outlay. The capital outlay is stated to be in the neighbourhood of £100,000 including the electrification of the mills, whilst a gross horse power of 450 is obtained. From reliable figures I have before me, the electrification of the mills to absorb the 450 h.p. should not have exceeded, say, £10,000, and we therefore arrive at a capital outlay of £90,000 on this hydro-electric plant, which works out at about £200 per h.p. This figure is excessively high and cannot be economically justified in a country where coal is comparatively cheap, and probably more economical results would have been obtained by the installation of a Diesel or a superheated steam-engine plant.

I have also examined the financial aspect of electrical storage, and find that the probable cost of accumulators to absorb 230 h.p. would not have exceeded £15,000, so I frankly confess I do not see how on the basis of the figures available, the water-power storage scheme in this case could have been justified on a commercial basis. Even the estimated saving of £10,000 a year barely covers interest on capital and depreciation, and leaves nothing for redemption. Had a public supply been available, an outlay of £5,000 a year would easily have purchased all the power required.

As a contractor of water-power plants of over 20 years' standing, I am glad to see the interest roused on all questions of hydraulic power plants, but I submit with all due deference that if the development of water power is to follow sane lines, it is absolutely essential that the financial aspect is given very close consideration, as schemes not economically justifiable are bound to set back the development of water power in this country. I very much doubt whether schemes of this nature can be sound commercial propositions, when the capital outlay exceeds from £100 to £120 per horse power.

I was reminded, when I read the description, of the famous remark, "*C'est magnifique, mais ce n'est pas la guerre.*"

James Gordon, A.M.I.M.E.

London, *March 15th*, 1922.

A High-resistance Fault.

I have a three-core cable on a 3,000-volt a.c. circuit which I have found tests only 50,000 ohms between phases on all three cores, the test to earth being 20 megohms. I should be pleased if any reader would inform me how to find the exact spot where the fault is.

Review Reader.

March 13th, 1922.

Charges for Services.

I am pleased to note that my recent letter on the above charges has at least brought to light the fact that these are fairly general. However, I have yet to hear of the undertaking that makes its charges as steep as in this district, whether legal or otherwise. The lowest quotation yet received being £4 15s., for a single service, approximate length 2 yd., to supply to a shop requiring 2.5 A for lighting; the highest being £96 odd, for approximately 150 yd., so that Mr. Ashwell has evidently been let off lightly. It is certainly time that some check was put on the exorbitant charges made by some supply undertakings. The suburban resident is naturally unwilling to pay for something that will never be his own. It is, therefore, a stumbling block to electrical progress. During the last six months we have had 34 orders for installations turned down owing to these charges and 70 owing to lack of enterprise on the part of a supply authority in refusing to lay short extensions. The only alternative for the progressive contractor is to mark time until those responsible arise from their slumbers. What hopes?

Contractor.

Private House Lighting at 25 Periods.

I have read with interest Mr. T. R. Kernick's letter of February 17th, also the article he refers to. I estimate there are over 40,000 pairs of eyes that are seeing to read, work, and play by 25-cycle lighting in South Wales (not counting those who walk on streets lit by the same type of illumination), many of them for 18 years, and I have not noticed any abnormal effect upon their eyesight or their temperaments. I doubt if anyone sitting in a room illuminated by a gasfilled lamp in a semi-indirect fitting could tell the frequency of the supply.

C. T. Allan,
Assistant Manager,
The South Wales Electrical Power Distribution Co., Ltd.

Cardiff,
March 15th, 1922.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR FEBRUARY, 1922.

THE official returns of electrical export business for the month of February show a considerable falling off in values, the total being £992,778, a decrease of £376,000 on the January figures of £1,369,463. In comparing the figures, due allowance should be made for the fact that February contained fewer days than the previous month. Nearly all the items of electrical exports show decreased values, the principal reductions occurring in electrical machinery (£245,000 dec.), telegraph and telephone cable and material (£70,000 dec.), electrical goods and apparatus (£22,000 dec.), and insulated wire (£25,000 dec.).

The figures for electrical imports were £287,605, as compared with £155,581 for January, an addition of roughly £130,000; in electrical machinery imports an increase of £155,000 is recorded, whilst a falling off occurred in the items for electrical goods and apparatus of £14,000; and in telegraph and telephone imports of £10,000.

The re-export total of electrical goods and machinery, &c., at £25,245, was £10,000 up on the previous month, the figures for the glow lamps section showing an appreciation of £15,000, whilst reduced values were registered in other sections, principally in electrical goods and apparatus and telegraph and telephone cable and material.

VALUE OF ELECTRICAL EXPORTS AND IMPORTS FOR FEBRUARY, 1922.

	Exports. £	Imports. £	Re-exports. £
Electrical goods and apparatus (unenumerated)	100,356	36,561	2,659
Insulated wire	155,909	8,273	—
Glow lamps	29,583	22,127	15,832
Arc lamps and parts	385	571	—
Batteries and accumulators	24,999	3,365	—
Meters and instruments ...	35,728	4,810	665
Carbons	2,363	2,486	576
Electrical Machinery—			
Railway and tramway motors	15,178	—	—
Other motors and generators	177,240	—	—
Switchboards (not telegraph or telephone)	34,389	20	—
Electrical machinery (unenumerated)	191,597	198,163	3,896
Telegraph and Telephone Cable and Material—			
Telegraph and telephone wire and cable (not submarine)	34,234	2,600	—
Submarine telegraph and telephone cable	61,085	—	—
Telegraph and telephone instruments and apparatus	139,732	8,629	1,617
	£992,778	£287,605	£25,245

Philips' Glow-Lamp Works.—The directors of the N. V. Philips' Gloeilampen Fabrieken propose to pay a dividend for 1921 at the rate of 11 per cent. on the ordinary shares, and 7 per cent. on the preference shares, these rates comparing with 31 per cent. and 11 per cent. respectively in the preceding year.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

6,306. "Spark plugs." T. E. Rofe and S. le F. Varvel. March 3rd.
6,308. "Sparking plug." F. H. Harley. March 3rd.
6,323. "Electrical instruments in vacuo." M. A. Codd. March 3rd.
6,329. "Governing mechanism for multiple motor power plants." Metropolitan-Vickers Electrical Co., Ltd. March 3rd. (United States, March 3rd, 1921.)
6,330. "Cubicles for enclosed electric switchgear." Metropolitan-Vickers Electrical Co., Ltd., and E. E. I. Pilcher and A. E. L. Scanes. March 3rd.
6,332. "Electric hoisting device." B. Bomborn. March 3rd.
6,337. "High-frequency therapeutic applicators." R. A. S. Paget and J. R. Quain. March 3rd.
6,358. "Electric light fittings, &c." T. Cracknell. March 3rd.
6,363. "Dynamo-electric machines." Sir C. A. Parsons and J. Rosen. March 3rd.
6,372. "Arrangement for increasing speed of telegraphing over long lines." K. Kupfmuller and K. W. Wagner. March 3rd. (Germany, March 4th, 1921.)
6,373. "Increasing speed of signalling." A. E. O'dell (C. Lorenz Akt. Ges.) March 3rd.
6,380. "Electro magnets." British Thomson-Houston Co., Ltd. (General Electric Co.) March 3rd.
6,381. "Electric arc welding apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.) March 3rd. (United States, July 27th, 1921.)
6,392. "Head-lights for motor-cars, &c." J. Ward. March 4th.
6,423. "Systems of wireless telegraphy and telephony." G. T. Smith Clarke. March 4th.
6,436. "Electrical hot-air stove." G. Comboni. March 4th.
6,437. "Locking devices for electric incandescent lamps, &c." R. R. Bury and J. Stone & Co., Ltd. March 4th
6,453. "Device for testing sparking plugs and ignition systems of internal-combustion engines." J. J. Elias. March 4th.
6,465. "Radio-antenna systems." Ges. fur Drahtlose Telegraphie. March 4th. (Germany, March 5th, 1921.)
6,474. "Motor-vehicle lamps." B. W. Harcourt. March 4th.
6,495. "Apparatus for testing electrical apparatus and installations." G. C. Lang. March 6th.
6,518. "Telephone systems." W. Müller. March 6th. (Germany, March 4th, 1921.)
6,521. "Electric reading lamps, &c." J. Watson. March 6th.
6,536. "Telephone instrument apparatus and attachments." H. D. Pyne. March 6th.
6,554. "Incandescent electric lamps." A. C. Hyde. March 6th.
6,561. "Electrical burglar alarm systems, &c." J. F. Broom. March 6th.
6,574. "Generation of high-frequency electric oscillations." E. W. B. Gill, Marconi's Wireless Telegraph Co., Ltd., and J. H. Morrell. March 6th.
6,575. "Manufacture of electrical conductors." R. B. Ransford (Smith). March 6th.
6,580. "Signalling apparatus for road vehicles and aeroplanes." Arrota Electrical and Motor Accessories Co., Ltd., and H. Masterman. March 6th.
6,582. "Automatic voltage-regulators." C. H. Klyne. March 6th.
6,583. "Cable telegraphy." S. G. Brown. March 6th.
6,587. "Oil-filled electrical devices." British Thomson-Houston Co., Ltd. (General Electric Co.). March 6th.
6,598. "Method of shortening duration of telegraph signals on long lines." K. Küpfmüller and K. W. Wagner. March 6th. Germany, March 7th, 1921.)
6,608. "Apparatus for electrical ringing of bells." H. Marliere. March 6th. (Belgium, March 7th, 1921.)
6,622. "Galvanic batteries." L. Fuller and Fuller's United Electric Works, Ltd. March 7th.
6,633. "Anti-vibration fitting for electric light." A. Fortescue. March 7th.
6,637. "Induction motors." T. F. Wall. March 7th.
6,651. "Electric switches." A. L. Davis. March 7th.
6,685. "Driving-means for car-lighting dynamos." R. L. Wood. March 7th
6,709. "Electric switches." D. Tiniot. March 7th.
6,713. "Electric contact-makers for steering-wheels of motor-vehicles." Eural Patents, Ltd., and H. J. Waller. March 7th.
6,715. "Means for obtaining polar diagram of alternating electromotive force or current." J. T. M. Morris and F. R. F. Ramsay. March 7th.
6,717. "Electro-magnetic compasses." T. N. Whitehead. March 7th.
6,723. "Induction motors" W. F. Higgs. March 7th.
6,724. "Mine signalling apparatus." W. H. Cooper. March 7th.
6,732. "Tag blocks terminal strips, &c." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. March 7th.
6,734. "Controllers for electrically-operated cranes, hoists, &c." N. G. Langrish and Metropolitan-Vickers Electrical Co., Ltd. March 7th.
6,736. "Electric drilling machines." C. H. Vidal. March 7th.
6,740. "Wireless telegraphic and telephonic receiving instruments." H. P. R Rees. March 7th.
6,741. "Holders for electric incandescent lamps." A. Püschel. March 7th.
6,747. "Apparatus for re-magnetising magneto magnets and recharging secondary batteries." D. Forrest. March 7th.
6,755. "Regulating devices for electric installations." Etablissements De Dion-Bouton Soc. Anon. March 7th. (France, April 14th, 1921.)
6,758. "Rotors." A. Flettner. March 7th (Germany, March 9th, 1921.)
6,793. "Electric resistance welding." R. F. Woodburn. March 8th.
6,821. "Electrically-propelled vehicles." L. B. Hewitt and Metropolitan Electric Tramways, Ltd. March 8th.
6,822. "Electrical starting-mechanism for fluid-pressure engines." J. A. Cole, Humber, Ltd., and L. J. Shorter. March 8th.
6,827. "Waterproof electric blasting cap." A. L. Oliver. March 8th.
6,833. "Magneto detectors and astatic and directional magnetic compasses." A. E. Beattie. March 8th.
6,849. "Producing electro-anæsthetic current for treatment of nervous diseases." R. Araya. March 8th.
6,854. "Control of dynamo-electric machines." A. S. Cachemaille (Westinghouse Electric and Manufacturing Co.). March 8th.
6,856. "Methods of making silica or quartz glass." British Thomson-Houston Co., Ltd. (General Electric Co.). March 8th.
6,857. "Electricity meters." R. Amberton. March 8th.
6,858. "Electrical testing apparatus." R. Amberton and R. H. Barbour. March 8th.
6,862. "Means for converting a direct or unidirectional electric current into a high-frequency alternating current." P. d'Algneaux. March 8th.
6,867. "Electric ignition systems." J. Higginson. March 8th.
6,899. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd., and E. J. C. Rousseau. March 8th.
6,905. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. March 8th. (United States, February 20th.)
6,909. "Electric machines for heating rivets, &c." W. J. Readett. March 8th.
6,919. "Electric switches." W. Preston, H. S. Rogers, and W. Walker. March 9th.
6,953. "Sparking-plug terminals." E. Martin. March 9th.
6,955. "Electric lighting fixtures." R. M. Beard. March 9th.
6,962. "Lead connectors for electric terminals." J. Morgan and A. Morgan. March 9th.
6,993. "Ignition in internal-combustion engines." S. J. Frost. March 9th.
6,994. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). March 9th.
6,998. "Electric talking-machines, &c." J. H. Nicholson. March 9th.
7,001. "Wireless masts." C. J. Aston and A. G. T. Cusins. March 9th.
7,008. "Synchronous motor for electric drive of clockworks." R. Michl. March 9th.
7,041. "Electrical shop sign." H. L. Moisselle. March 10th.
7,047. "Leading-in wires for electric incandescent lamps." S. O. Cowper-Coles. March 10th.
7,048. "Joints of high-tension electric cables." A. M. Taylor. March 10th.
7,105. "Current-collecting apparatus for electric railways and tramways." A. A. Bull. March 10th
7,106. "Current-collecting apparatus for electric railways and tramways." C. W. Kay. March 10th.
7,107. "Current-collecting apparatus for electric railways and tramways." C. W. Kay. March 10th
7,121. "Ventilating or cooling electrical machines." K. Baumann, Metropolitan-Vickers Electrical Co., Ltd. March 10th.
7,125. "Protective arrangements for alternating-current electric circuits." R. W. Biles and A. Reyrolle & Co., Ltd. March 10th.
7,126. "Electric switch-fuses." Electrical Improvements, Ltd., and R. W. Gregory. March 10th.
7,142. "Element for storage-battery cells." E. Vare. March 10th. (Belgium, March 10th, 1921.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

23,536. "Magnetic blow-out devices." A. West & Co., Ltd., and V. Breeze. May 11th, 1921. (175,663.)
24,836. "Electric arc welding systems." Wilson Welder and Metals Co., Inc. February 18th, 1920. (159,488.)
25,356. "Spark-plug connections." R. McGreevy. September 2nd, 1920. (175,671.)
26,246. "Electrolytic cells.' J. Harris and J. R. Ross. September 13th, 1920. (175,672.)
28,906. "Means for controlling electric currents and for detecting or recording radio-signals." C. S. Agate and P. W. Willans. October 12th, 1920. (175,679.)
29,128. "Apparatus for maintaining a gas electrode in operative condition." F. P. Habicht. October 14th, 1919. (152,364.)
31,943. "Means for generating and transmitting electric currents to electric reciprocating hammers and the like." H. Fairbrother (Electric Tool Manufacturing Co., Inc.). November 11th, 1920. (175,714.)
32,0[illegible]. "Electric light installations for alternating current." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 5th, 1919. (155,238.)
32,238. "Magneto-electric generators for signalling purposes." S. G. Frost. November 15th, 1920. (175,720.)
32,537. "Train-control systems." Automatic Telephone Manufacturing Co., Ltd., A. E. Hudd, and A. F. Bound. November 18th, 1920. (175,733.)
32,748. "Electric cooking apparatus." E. Kuhlo. November 20th, 1919. (154,194.)
32,813. "Construction of high-tension electric cables." W. T. Henley's Telegraph Works Co., Ltd., P. Dunsheath, and C. Grover. November 20th, 1920. (175,753.)
32,936. "Electrical switches." H. Garde. November 22nd, 1920. (175,716.)
33,056. "Wireless transmission of signals." Title Insurance and Trust Co. August 27th, 1917. (154,530.)
33,060. "Method of and apparatus for locating ore bodies by electrical means." E. C. Hanson. May 7th, 1919. (154,534.)
33,061. "Electro-therapeutic apparatus." E. C. Hanson. July 12th, 1919. (154,535.)
33,068. "Electric lighting, heating, and power installations." H. J. Read and W. J. Branson. November 23rd, 1920. (175,760.)
33,188. "Means for recording telephone calls." A. W. Wood. November 24th, 1920. (Cognate application 3,699/21.) (175,763.)
33,829. "Hydrophones." F. L. Hopwood. November 30th, 1920. (175,783.)
33,830. "Directional hydrophones." F. L. Hopwood. November 30th, 1920. (175,784.)
33,965. "Electrical transformers." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). December 1st, 1920. (175,788.)
34,120. "Electric hoists, lifts, inclined railways, and the like." Waygood-Otis, Ltd. (Otis Elevator Co.). December 2nd, 1920. (175,793.)
34,157. "Means for locking and unlocking electric switch plugs." J. H. Gath. December 3rd, 1920. (175,794.)
34,254. "Automatic couplings for railway, tramway, and similar vehicles." A. L. McColl. December 3rd, 1920. (175,799.)
34,574. "System of control from a distance for regulating devices of electric vehicles." Maschinenfabrik Oerlikon. December 30th, 1919. (156,089.)
34,804. "Electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). December 9th, 1920. (175,815.)
35,093. "Automatic locking-devices for manually-operated brakes used on tramway, railway, and like vehicles." S. Thomas. December 13th, 1920. (175,823).
35,213. "Means for jointing submarine electric cables." W. T. Henley's Telegraph Works Co., Ltd., and E. E. Judge. December 14th, 1920. (175,826.)
36,448. "Jointing of armoured electric cables." British Insulated and Helsby Cables, Ltd., and R. W. Blades. December 30th, 1920. (175,852.)
36,488. "Protective device for direct-current electric motors." C. E. Fairburn. December 30th, 1920. (175,853.)

1921.

2,791. "Electric motor-control systems." T. Zweigbergk. January 21st, 1921. (175,877.)
2,899. "Electrical accumulators." Van Raden & Co., Ltd., and R. Rankin. January 22nd, 1921. (175,878.)
3,010. "Systems of voltage regulation." British Thomson-Houston Co., Ltd. (General Electric Co.). January 24th, 1921. (175,879.)
3,739. "Means or apparatus for coupling electric cables and the like." G. Andrew and F. H. Wilkinson. February 1st, 1921. (175,887.)
5,393. "Construction of electric accumulators." G. W. Richards. February 16th, 1921. (175,896.)
7,143. "Apparatus for treating gases with silent electric discharges." I. Szarvasy. February 15th, 1918. (159,843.)
13,824. "Apparatus for starting electric synchronous motors." Compagnie Générale Electrique. October 6th, 1920. (169,953.)
19,479. "Telephonographs and the like." Telegraphon Ges. Aug. 24th, 1920. (168,305.)
21,017. "Electrical circuit breakers." Metropolitan-Vickers Electrical Co., Ltd. October 18th, 1920. (170,556.)
33,354. "Oil-break electric switch with resistance," Maschinenfabrik Oerlikon. December 10th, 1920. (172,658.)

1922.

2,008. Train-control systems and apparatus for use therewith." Automatic Telephone Manufacturing Co., Ltd., A. E. Hudd, and A. F. Bound November 18th, 1920. (Divided application on 175,733.) (175,945.)